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PREPARATION OF THIS DOCUMENT

This document contains the discussion papers and case studies presented at the Norway-FAO Expert Consultation on the Management of Shared Fish Stocks, Bergen, Norway, 7-10 October 2002. The views expressed in these papers are those of the authors and should not be attributed to FAO or its Members.

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ABSTRACT

The Norway-FAO Expert Consultation was held in recognition of the fact that the management of shared fishery resources remains one of the great challenges on the way towards achieving long-term sustainable fisheries. A critical input into the proceedings of the Expert Consultation were two discussion papers and 12 case studies. The first discussion paper addresses the basic requirements and principles for successful management of shared fish stocks derived from game theoretical considerations and practical experiences. The second discussion paper presents the legal aspects of the management of shared fish stocks including relevant provisions in the 1982 UN Convention on the Law of the Sea and other international legal instruments. The case studies present experiences with the management of shared fish stocks from various regions of the world. The case studies identify critical success factors in the various stages and for the various functions of cooperative management including information exchange and sharing, negotiating agreements, implementation procedures and related institutional and legal arrangements.

TABLE OF CONTENTS

DISCUSSION PAPERS

THE MANAGEMENT OF SHARED FISH STOCKS

by

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INTRODUCTION

The Government of Norway, in cooperation with FAO, is to hold an Expert Consultation on the management of shared fishery resources. The Consultation is being convened in recognition of the fact that the management of these resources stands as one of the great challenges on the way towards achieving long-term sustainable fisheries. The objective of the Expert Consultation is to assist countries in improving their efficiency and performance in meeting this challenge.

This paper is designed to serve as one of several background documents for the Expert Consultation. As such, it will attempt to perform two tasks. First it will review definitions, legal and otherwise, of shared stocks and attempt to outline the scope and magnitude of the relevant resource management issues, on a worldwide basis.

The Concept Paper for the Expert Consultation refers to the academic, or theoretical, aspects of the management of shared fishery resources, and, in so doing, states that these aspects should serve as a background for the Expert Consultation. The second task of this paper, then, will be to review these academic aspects in a non-technical manner, and go on to illustrate key points arising from the academic analysis, by drawing upon brief case studies from the real world. It is anticipated that all of the case studies drawn upon in the paper will be discussed in detail during the Expert Consultation.

SHARED FISH STOCKS: AN OVERVIEW

Some Definitions

The term "shared fish stocks" is understood, by the FAO and others, to include the following:

(a) fish resources crossing the exclusive economic zone (EEZ) boundary of one coastal State into the EEZ(s) of one, or more, other coastal States – transboundary stocks

(b) highly migratory fish stocks, which, due to their highly migratory nature, are to be found, both within the coastal State EEZ and the adjacent high seas

(c) all other fish stocks (with the exception of anadromous/catadromous stocks) that are to be found, both within the coastal State EEZ and the adjacent high seas – straddling stocks

(d) fish stocks to be found exclusively in the high seas

Clearly, these categories are not mutually exclusive. One can find many examples of fish stocks that fall into category (b), or category (c), which also fall into category (a). Be that as it may, it is the express intention of

the Norway-FAO Expert Consultation on the Management of Shared Fish Stocks to focus its attention on categories (a) and (e) stocks, that is to say, on transboundary and straddling stocks.

John Caddy (1997) provides a definition of transboundary stocks, which, with minor modification, can be extended to cover straddling stocks. The modified Caddy definition is as follows:

a group of commercially exploitable organisms, distributed over, or migrating across, the maritime boundary between two or more national jurisdictions, or the maritime boundary of a national jurisdiction and the adjacent high seas, whose exploitation can only be managed effectively by cooperation between the States concerned ----

Not all would agree with Caddy, by the way, that these resources can only be managed effectively by the relevant States agreeing to cooperate. Indeed, this is one of the key issues to be discussed.

Having said this, the participants in the UN Third Conference on the Law of the Sea certainly took the view that cooperation was required for the management of such resources, as evidenced by the UN Convention on the Law of the Sea, arising from the Conference (1982 UN Convention, hereafter) (UN, 1982). Relevant States are admonished to so cooperate in Article 63(1), and Article 63(2) of the Convention. Article 63(1), the transboundary stocks paragraph, reads as follows:

> *Where the same stock or stocks of associated species occur within the exclusive economic zones of two or more coastal States, these States shall seek, either directly or through appropriate subregional or regional organizations, to agree upon measures necessary to coordinate and ensure the conservation and development of such stocks without prejudice to other provisions of this Part,*

while Article 63(2), the straddling stocks paragraph, is as follows (UN, 1982):

> *Where the same stock or stocks of associated species occur both within the exclusive economic zone and in an area beyond and adjacent to the zone, the coastal State and the States fishing for such stocks in the adjacent area shall seek, either directly or through appropriate subregional or regional organizations, to agree upon measures necessary for the conservation of these stocks in the adjacent area.*

At the close of the UN Third Conference on the Law of the Sea, there was a clear recognition that, under Extended Fisheries Jurisdiction, transboundary fish stocks would present major resource management problems. It was not expected that straddling fish stocks would be a source of serious management problems, if for no other reason than that only 10 percent of the commercially exploitable marine capture fishery resources were to be found in the remaining high seas (or so it was believed) (Munro, 2000). The experience of the second half of the 1980s, and the early 1990s, was to demonstrate that this sanguine view of straddling fish stocks was quite simply wrong.

Some Characteristics of Transboundary and Straddling Fish Stocks

One of the earliest analyses of the problems of management of shared fishery resources was that prepared by John Gulland (1980). In his article, Gulland focuses on transboundary fishery resources, because of their then apparent importance. His analysis can, however, be readily extended to straddling fish stocks.

In any event, Gulland presents a biological/geographical categorization of transboundary fish stocks, which is useful in setting the stage for the discussion of the problems of managing the resources. He makes the following distinctions:

I. stocks occurring within two or more EEZs, but showing no clear migratory pattern
II. stocks occurring within two or more EEZs, and displaying a clear pattern of movement:
    1) resulting from seasonal migration
    2) according to development stages

Change *stocks occurring within two or more EEZs*, in I and II, to *stocks occurring within the EEZ and the adjacent high seas*, and one has a description of straddling fish stocks.

In the case of (I), Gulland contends, it is not always clear that exploitation on one side of the relevant boundary will necessarily have a significant impact upon harvesting opportunities on the other side of the boundary. Munro (1987) provides such an example in the form of the rich Georges Bank scallop fishery, shared by Canada and the United States. The resource was, and is, clearly a transboundary fish stock. It was, however, questionable whether Canadian (American) harvesting of scallops would have any significant impact upon American (Canadian) harvesting opportunities. Adult scallops are more or less stationary. Moreover, while there is some transboundary movement at the larval stage, there were, in 1987, extensive beds of larvae producing scallops, which were free from exploitation due to the sea bed terrain.

These facts led to the argument that, since Americans and Canadians could harvest the resource with out affecting one another's harvest opportunities, cooperative fisheries management of this shared resource was beside the point (Munro, 1987). Whether the situation, which prevailed in 1987, continues to prevail today is not known to this writer. Nonetheless, the point remains, and leads to our first conclusion, namely that cooperative fisheries management of a "shared" fishery resource is not, in all cases, necessarily required, or desirable. The conclusion is reinforced by the fact that establishing a cooperative fisheries management regime is not a costless undertaking. If the net benefits from cooperation are negative, then obviously the case for cooperation collapses.

Levels of Cooperation in Resource Management

Suppose now that the harvesting activities of one state sharing a fishery resource do impinge significantly upon the harvesting opportunities of the one, or more, other states sharing the resource, so that a *prima facie* case for cooperation does, in fact, exist. The question, which then arises, is the appropriate level of cooperation. There are, as Gulland points out, at least two levels of cooperation (Gulland, 1980). The first level, or what we might term the primary level, consists of cooperation in research alone, without reference to coordinated management programs. Since all parties should stand to benefit from improved information and data, the cooperation should be relatively easy to achieve. The emphasis is on the word relative, however. It is still possible that one or more parties may suspect that research information, which it shares, will serve to benefit its rival exploiters of the resource, at its own expense.

In any event, if it is not possible to achieve cooperation at this primary level, it certainly will not be possible to achieve cooperation in active management of the resource. In actual cooperative management regimes, which have proven to be successful, cooperation in research alone is often seen, in retrospect, to have been the precursor to cooperation in active management.

What we might call secondary cooperation -"active management"- involves, almost by definition, the establishment of coordinated joint management programs.
As Gulland (1980) informs us, this will require:

(a) determination of an optimal management strategy through time, including, *inter alia*, the determination of optimal global harvests over time
(b) allocation of harvest shares among the participating states (or entities)
(c) implementation and enforcement of coordinated management agreements.

Obviously, this is a much more formidable undertaking than the primary level of cooperation. To begin, even cooperation in research may lose its benign character. Research findings can influence harvest allocations, and thus can, as will be pointed out in case studies to follow, easily become "tools of combat" in negotiations between and among relevant states.

For a second example, consider (a). There is no assurance that the relevant states will have identical resource management goals. The FAO recognized this fact, as early as 1979, with reference to transboundary stocks, through its Advisory Committee on Marine Research (FAO, 1979). The Committee pointed out that, if two coastal states share a fishery resource, one might favour low long run TACs, but a large stock and high catch rates, while the other might favour high long run TACs, and accept with good grace low catch rates. If

management goals are not identical, then one is faced with the burden of developing a mutually acceptable compromise resource management program, or so it would seem (FAO, *ibid.*).

Thus, establishing cooperative management at the secondary level can prove to be frustrating and costly. One can add that the anticipated cost might be not only be in monetary form, but may also appear, as far as coastal states are concerned, in the form of perceived loss of sovereignty. If, what we might call the gross benefits from cooperative management, appear not to be substantial, the relevant states may conclude, to use an old English expression, that "the game is not worth the candle".

Each relevant state could conclude that the aforementioned gross benefits of cooperation are not substantial by taking that view that, if it, and its fellow states sharing the resource, manage their respective segments of the resource in a rational manner, the overall resource management results, while not being ideal, will be adequate. One of the central questions to be addressed in the discussion of the analytical aspects of this resource management issue, is whether or not this comfortable view of the world is, in fact, reasonable.

The Significance of Shared Fish Stocks in World Capture Fisheries

Difficulties of achieving effective cooperation in resource management to one side, the significance of the issue of cooperative management of shared fishery resources is dependent ultimately upon the importance of shared fishery resources in terms of world fisheries. The most complete investigation of this question is to be found in Caddy (1997). Caddy's investigations, it must be noted in passing, are confined to transboundary fish stocks.

Caddy first observes that he pointed out in 1982, as the world EEZ regime was emerging, that a significant proportion of fishery resources then being encompassed by EEZs would be found to be shared with other coastal States. He subsequently proceeds, with the aid of the Geographical Information System database, to estimate the number of contiguous EEZ maritime boundaries. Then, making a very conservative estimate of the number of fishery resources crossing these boundaries on average, he comes forth with an estimate of 1,000 to 1,500 transboundary fishery resources. The number is large indeed. He then maintains that the number of such resources under effective cooperative resource management regimes is very modest, in relation to the global total (Caddy, 1997). We can only guess at the number of additional stocks that have to be included, once straddling fish stocks are taken into account.

If it is in fact the case that cooperative management is important for the long term sustainability of most of these resources, then the Caddy analysis forces us to the following conclusions. First, the scope for improved management of shared fishery resources is immense. Secondly, potential significance of such an improvement to world fisheries is very high indeed.

A REVIEW OF THE BASIC ECONOMICS OF THE MANAGEMENT OF TRANSBOUNDARY FISH STOCKS

The economics of the management of shared fish stocks has been developed in two stages. The first stage, which dates back to the late 1970s (Munro, 1979), has consisted of developing the economics of the management of transboundary fish stocks. This is a reflection of the fact that, at the dawn of Extended Fisheries Jurisdiction, the management of transboundary fish stocks was recognized as being an important problem, while the management of straddling fish stocks was not.

It is also a reflection of the fact that the management of transboundary fish stocks is considerably less complex than is the management of straddling fish stocks. In the case of transboundary fish stocks, in contrast to straddling fish stocks, the states involved are, with few exceptions, fixed through time, and the shared, or joint, property rights to the relevant resources are reasonably straightforward MeRae and Munro, 1989). Furthermore, the number of states involved is usually relatively small. In the economic analysis of the management of these resources, one can often make do with models consisting of just two countries.

The second stage, consisting of the development of the economics of the management of straddling (and highly migratory) fish stocks, dates back only to the early 1990s (Kaitala and Munro, 1993). In the second stage, the economics of the management of transboundary fish stocks is used as a foundation. The question is

then asked what modifications to, and what extensions of, the analysis are required, in light of the special problems arising from, and issues raised by, the management of straddling fish stocks. The question has by no means been fully answered at the time of writing. The second stage is thus very much a "work in progress".

We commence then, with a review of the basic economics of the management of transboundary fish stocks. In the section to follow, we shall review the economics, as it now stands, of the management of straddling fish stocks.

The basic economics of the management of transboundary fish stocks, which is now reasonably well developed, has moved well beyond the realm of academic economists. It is finding its way into official publications, as exemplified by the 1997 Organisation for Economic Cooperation and Development (OECD) publication, *Towards Sustainable Fisheries* (OECD, 1997), and the study, *Managing Transboundary Stocks of Small Pelagic Fish*, prepared by M. Agüero and E. Gonzalez for the World Bank (Agüero and Gonzalez, 1996). It is also being discussed by specialists in fisheries, from disciplines other than economics. The 1997 paper by John Caddy (Caddy, 1997), which has been, and will be, cited extensively, provides a case in point.

The economic model, which is used in the analysis of the management of transboundary fishery resources, is a blend, consisting of two components. The first component consists of the now standard bioeconomic model used for the analysis of fisheries confined to waters of a single coastal State (see, for example: Clark, 1990; OECD, 1997). The second component consists of the theory of games. The reason for incorporating game theory into the analysis is the realization that, without game theory, the analysis of the economics of shared fish stock management degenerates into incomprehensibility.

On the assumption that most readers are not familiar with the theory of games, we turn now to a review of the essentials of the theory.

The Theory of Games: A Brief Overview

The theory of games is designed to analyze strategic interaction between and among individuals", be the individuals" persons, firms, nations or others. The theory of games is relevant when the actions of one "individual" has a clearly perceived impact upon other "individuals", thereby inviting a reaction from these other "individuals". One field of economics, where game theory has come to play a major role, is Industrial Organization, which is generally devoted to the study of industries dominated by a few large firms. Let the airline industry serve as an example. The fare structure, and other policies, implemented by a major airline, such as SAS, is bound to have an impact upon rival airlines. The rivals can be expected to react. SAS will, of course, anticipate such reactions, and will factor these expected reactions into its planning.

Industrial Organization is only one of numerous fields, in which one can anticipate interactions between and among "individuals". Many fields of economics are influenced by game theory, as now are many areas outside of economics, such as international relations and legal studies. The use of game theory is also to be found in some natural sciences. Game theory does, for example, play a major role in evolutionary biology.

Cooperative resource management between, or among, coastal States sharing a fishery resource becomes worthy of consideration, we have now argued, if the harvesting activities of one coastal state has a significant impact upon the harvesting opportunities open to the other state(s) sharing the resource. If this condition is met, then strategic interaction between "individuals", in the form of states sharing the resource, becomes virtually inescapable. It is for this reason that it was very difficult to make significant progress in developing the economics of the management of transboundary fishery resources, until the analytical tools provided by the theory of games were brought to bear.

Perhaps the greatest drawback, from which the theory of games suffers, is its very name. It creates the impression that the theory is frivolous. It is not. In recognition of the theory's rapidly growing application, the 1994 Nobel Prize in Economics was awarded to a trio of game theorists, one of whom, John Nash, can be seen as the founder of modern game theory, as applied to economics. In commenting on the award, *The Economist* (October 15, 1994), argued that, whereas up to the early 1970s, game theory was seen as an esoteric specialty, now no one hoping for a respectable degree in economics can expect to receive the degree,

without an understanding of at least the rudiments of game theory. In the same article, *The Economist* maintained that the time is coming when game theory will be commonplace among MBA students, as well.

In the terminology of game theory, the "individuals" are referred to as "players". The "players" are assumed to be rational and to have various courses of action open to them, which are referred to as "strategies". The expected return to a player, in following a particular strategy, is then referred to as a "payoff". The size of the expected return or "payoff" will, needless to say, be dependent upon the expected reactions of other "players". The interaction between, or among, the players, as they execute their strategies, is the game. The stable outcome of a game, if it exists, is termed the "solution" to the game. Finally the game may be a "once only" affair, or it may be repeated.

There are two broad categories of games, these being competitive, or non-cooperative, games, and cooperative games. In a cooperative game, the players are assumed to be motivated entirely by self interest, but have some incentive to endeavour to cooperate. Of critical importance is the fact that players are able to communicate with one another effectively. In competitive, non-cooperative, games, the lines of communication between and among the players are faulty, or are simply non-existent.

In analyzing the economics of the management of shared fishery resources, economists have asked themselves two fundamental questions, with the first one being: what are the consequences of coastal states sharing a fishery resource refusing to cooperate in the management of the resource? The implication is that, in the absence of cooperation, each coastal state will simply go its own way and manage its segment of the resource as best it can. If the answer to the question is that the negative consequences of non-cooperation are trivial, then one need proceed no further.

If, on the other hand, the answer to the question is that the negative consequences of non-cooperation are severe, then cooperation does matter and the second fundamental question must be asked. The second question is what requirements must be met for a cooperative resource management regime to be stable and sustainable over the long run? It might be mentioned, in passing, that the second question raises the issue of equity. Cooperative management regimes that are perceived by one or more players as being inequitable are, by definition, unstable.

Non-cooperative Management of a Shared Fishery Resource

The first question, that of the consequences of non-cooperative management of a shared fishery resource, is addressed, not surprisingly, by bringing to bear the theory of non-competitive games. Consider a two "player" (coastal state) game. Those who have investigated the question usually assume that each of the two players has full and effective resource management powers within it own waters, although we shall want to comment on this at a later point.

A stable solution to a non-cooperative game was defined by John Nash (1951) as situation in which each player has no incentive to change, given the strategies being followed by the other player. Two independent investigations of the non-cooperative fisheries game were published in 1980 (Clark, 1980; Levhari and Mirman, 1980). Both came to the same conclusion. A stable solution to the game would involve, except in unusual circumstances, mismanagement of the resource from society's point of view. Clark (1980) argues that, if the players are symmetric, i.e. identical in all respects, the outcome will be similar to the that encountered in an unrestricted open access domestic fishery, referred to in the economics literature as Bionomic Equilibrium (Gordon, 1954). Bionomic Equilibrium is characterized by overexploitation of the resource, from society's point of view, and by fleet capacity far in excess of that which would be required, if the resource were exploited optimally. The overall outcome to the game is an example of what is probably the most famous of all non-cooperative games, known as the "Prisoner's Dilemma".

The point of the "Prisoner's Dilemma" game is that the players in the non-cooperative game will be driven to adopt strategies, which each recognizes as being undesirable. The name comes from a story told by the author of the game to illustrate the point (Tucker, 1950). Two men are arrested on suspicion of having committed a major theft. The suspicions are, in fact, entirely valid. The two suspects, A and B, are kept separated from one another. A is interviewed by the chief prosecutor, who admits that the evidence, which he has, is limited. A is told that, if both he and B plead not guilty, they can each expect to receive a six month

sentence on a lesser charge. If both A and B plead guilty, they will each receive a five year sentence. If A pleads guilty, but B pleads not guilty, A will be released for having assisted the prosecution. If A pleads not guilty, but B pleads guilty, then it will go very hard with A, and A will get ten years. The chief prosecutor then holds exactly the same interview with B.

A and B are the players. Each player has two alternative strategies: to plead guilty, or to plead not guilty. If A and B could communicate, and enter into a binding agreement, they would both plead not guilty, and would look forward to being out of prison in six months time. They cannot communicate, however. The best strategy for A, regardless of which of the two strategies B might choose, is to plead guilty. What is true for A is true for B. Hence, both plead guilty and end up with the decidedly inferior outcome of serving five year sentences[1].

Now let us apply the concept of the "Prisoner's Dilemma", to a somewhat different fisheries situation. Let A and B be two "symmetric" coastal states sharing a resource, neither of which had, in the past, engaged in serious management of the resource. The resource is, consequently, overexploited, at the common Bionomic Equilibrium level, a fact, which is recognized by both A and B. A and B are now exhorted by an outside international body to undertake meaningful management of their respective portions of the resource. There is, however, no thought of cooperation between A and B.

Consider A, which has two "strategies" before it: undertake the cost of management, or do nothing. Suppose that A does undertakes the cost of a serious management program, and that the resource, for a time, rises above the Bionomic Equilibrium level. In the absence of cooperation, the outcome is not stable, and the resource will be driven back down to where it started. B would have the pleasure of enjoying some temporary benefits from A's management efforts, at no cost to B. We would refer to B, in these circumstances, as a "free rider". For A, undertaking the cost of management, is, at best, an exercise in futility. If A does nothing, and if B is foolish enough to engage in resource management, A will enjoy the rewards of being a "free rider". Obviously A's best strategy will be to do nothing. B is faced with the same set of strategies. What holds true for A, holds true for B. Thus we can predict that A and B will do nothing, while continuing to recognize the consequences of the absence of effective management.

The predictive power of the theory, with respect to transboundary fisheries, is high. One example, to which reference will be made in the brief case studies, is that of Pacific salmon shared by the United States and Canada. The two countries signed a treaty to manage the resource cooperatively in 1985 (Treaty, 1985).

Both countries have a highly developed capacity for fisheries management systems. Nonetheless, there was a constant threat of the outbreak of damaging "fish wars" prior to the signing of the treaty. Furthermore, it was recognized that both countries had opportunities to enhance the size and strength of the stocks produced in their salmon rivers, through various enhancement projects. Each country held back on initiating such projects, for fear that the other would "free ride" (Munro and Stokes, 1989). Indeed, it was the combined threat of "fish wars" and the continued blocking of enhancement projects, which served as a prod to drive the negotiators on, until they finally achieved (temporary) success.

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[1] We can show the outcome in terms of a Payoff Matrix, in which the payoffs are in terms of prison sentences. Consider the following, adapted from Luce and Raiffa (1957):

Prisoner A\ Prisoner B	Pleads guilty	Pleads not guilty
Pleads guilty	5 years each	0 years for A, and 10 years for B
Pleads not guilty	10 years for A, and 0 years for B	½ year each

Suppose that Player B pleads guilty. Player A would clearly be better off pleading guilty. Suppose that player B pleads not guilty. Player A would, once again, clearly be better off pleading guilty. Regardless of what strategy player B may adopt, the best strategy for player A is to plead guilty. Hence, pleading guilty is the dominant strategy for player A. What holds true for player A, also holds true for player B.

The Treaty, while initially successful, encountered difficulties in the early 1990s, and came close to foundering. The two countries reverted to destructive competitive behaviour; the "Prisoner's Dilemma" returned with a vengeance. The two sides, eventually "patched up" the treaty by signing an Agreement in 1999. While the Agreement has many critics, even the severest critics, with the thought of "fish wars" in mind, concede that an agreement, however flawed, is better than no agreement at all (Miller, Munro, McDorman, McKelvey and Tyedmers, 2001).

The implication of the analysis is straightforward. Even if coastal States sharing a resource have the capability of managing effectively fishery resources within their domestic waters, one has no justification in assuming that, in the absence of cooperation, the resource management outcome will be "adequate". The risk exists that the outcome will be disastrous. Other than in exceptional cases, cooperation does matter, and is, moreover, to be seen as a prerequisite for effective management, and not merely as a useful supplement to resource management by individual states.

Consider the following example. The FAO has in place an International Plan of Action for the Management of Fishing Capacity (FAO, 1999). The IPOA–Capacity does, *inter alia*, talk about the importance of addressing the problem of excess fleet capacity in the management of shared stocks (FAO, *ibid.*, p.2). One can be confident that, if shared stocks plagued by excess fleet capacity are managed non-cooperatively, the excess capacity problem will continue indefinitely, IPOA or no IPOA.

Cooperative Management of Transboundary Fish Stocks: Some Preliminaries

In examining cooperative management of shared fishery resources, one brings to bear, not surprisingly, the theory of cooperative games. Moreover, just as reference was made to Nobel Laureate John Nash's theory of non-cooperative games, so extensive reference will be made to John Nash's theory of cooperative games (Nash, 1953).

The theory of cooperative games is to be seen, first and foremost, as a theory of bargaining. It is, to repeat, assumed that each player is motivated by self interest alone. If the players agree to cooperate, it is because each is convinced that it can gain more from cooperation, than it can by engaging in competitive behaviour.

In cooperative games, numbers are important. Once the number of players exceeds two, the analysis becomes much more complex. One has to allow for the possibility of sub-coalitions forming among the players, and acknowledge the fact that the greater are the number of players, the more difficult it is to achieve a stable solution to the game. For the discussion to follow on transboundary stocks, we can safely restrict ourselves to the more tractable two player games. When we come to discuss the management of straddling stocks, however, we shall be have no choice but to deal head on with games having more than two players, and the complications arising therefrom.

Next, one has to be concerned with whether a cooperative agreement, if it reached, is, or is not, binding. Obviously binding agreements present fewer problems than non-binding ones. Agreements in treaty form can, according to legal experts, be thought of as binding (Owen, 2001). Experience, however, gives us the warning that even agreements in treaty form may be less than fully binding over time.

In the Overview of Shared Fish Stocks section, it was noted that FAO recognized, well before the conclusion of the UN Third Conference on the Law of the Sea, that there is no necessary reason why the states, sharing a fishery resource, should have the same management goals. Hence, the next question is whether those states sharing the resource do, or do not, have identical management goals. If the states are identical, and thus have identical management goals, they are said to "symmetric". If the states are symmetric, then the theory tells us that the states will attempt to institute a resource management program, which will maximize the global economic returns from the fishery over time, and will then bargain over the division of the returns. If management goals differ, then the added problem has to be faced of developing a compromise resource management program.

Finally, in this list of preliminaries, is the question of so call "side payments". A side payment, in its simplest form, is a type of transfer, which may be either monetary or non-monetary in nature. We shall define, for our

purposes, a fisheries cooperative game, without side payments, as one in which one coastal state's return from the shared fishery is determined solely by the harvests of its fleet(s) within it own waters. The importance of side payments, although practitioners will seldom use this term, has become increasingly recognized over the past few years (see: Caddy, 1997). It will be seen that one role that side payments can play is that of helping to resolve the problem, which arises when the relevant coastal states have differing management goals.

Conditions for Stable Cooperative Arrangements: Two Players

There are two basic conditions, which must be met, if there is to be a stable solution to the cooperative game. Both are straightforward, and seem entirely compatible with common sense. The first requires some additional economist's jargon. The early 20th Century Italian economist, Wilfred Pareto, put forth the proposition that in trade, or other dealings between, and among, individuals, the outcome was certain to be less than optimal, if it were possible by a rearrangement of the dealings to make one individual better off, without making the other individual(s) worse off. This gave rise to the concept of "Pareto Optimality", which means that a stage, or situation, has been reached in which it is not possible to make one individual better off, except at the expense of the other individual(s).

The first requirement for a stable solution to the two player cooperative game is that it be "Pareto Optimal". Suppose that the cooperative game consists of two players, coastal states, I and II, and that the "solution" to the cooperative game consists of an agreed upon cooperative resource management regime. If changes could be made to the cooperative management regime that would make both I and II better off, then the "solution" to the cooperative game can hardly be regarded as stable. Once the two states realized that, by altering the cooperative management regime, both would be made better off, the two would, if rational, do just that. What could be more straightforward?

The second requirement for a stable solution to the cooperative game has equal appeal to common sense, although one has no difficulty of finding examples in the real world where this common sense requirement is ignored. This requirement is sometimes referred to as satisfying the Individual Rationality Constraint. It states that a solution to the cooperative game will not be stable, unless the payoffs arising from the solution make each and every player at least as well off as it would be under conditions of non-cooperation.

Those potential solutions to the cooperative game, which satisfy both requirements, are said to constitute the "core" of the game. This immediately raises the question as to whether one can always be certain that such a "core" exists. The answer is no, the "core" can be empty. If that is the case, then there are no solutions, which will satisfy both requirements. Attempts to establish cooperation will prove to be futile, and the players will revert to competitive, non-cooperative, behaviour, with all that that implies.

We turn now to a widely used figure illustrating the conditions necessary for a stable solution to the cooperative game. The figure appears in the aforementioned 1997 OECD publication, 1996 World Bank publication, and appears, as well, in the 1997 paper by John Caddy (Agüero and Gonzalez, 1996; Caddy, 1997; OECD, 1997).

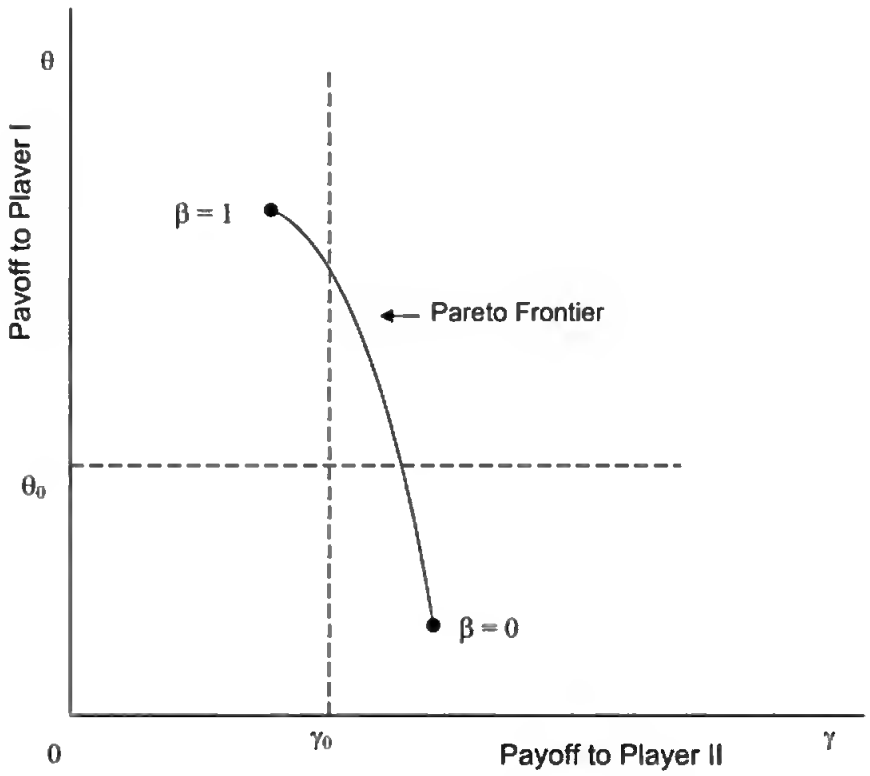
The figure is meant to represent a two player, (two coastal states I and II), cooperative fisheries game. The axes show the "payoffs" to the two respective players. A given payoff to player I measures the stream of economic returns through time to player I, arising from given resource management program. Correspondingly, a given payoff to player II measures the stream of economic returns to that player from a given resource management program.

It is assumed, in this example, that: i the two players are not symmetric, they do not have identical management goals; ii if a cooperative arrangement is achieved, it will be binding; and iii there is no allowance for side payments.

The solid curve represents the Pareto Frontier, in that it shows the payoffs from cooperative management regimes, in which it is not possible to make I better of, except at the expense of II, and vice versa. If we commence at the top of the curve at $\beta = 1$, we would have a cooperative management program that would maximize the benefits from the fishery to player I. As we move down the curve, player II would become

successively better off, but only at the expense of player I. By way of contrast, if we were at *any* point below the Pareto Frontier, both players I and II could be made better off by adjusting the cooperative resource management program.

Figure 1. A Cooperative Game Without Side Payments



The parameter β, to which we have referred, is, in fact, a bargaining parameter, $0 \leq \beta \leq 1$. If $\beta = 1$, then the management preferences of I are wholly dominant, while the management preferences of II count for nothing. If $\beta = 0$, the reverse is true.

The payoffs, θ_0 and γ_0, are the payoffs, which I and II would enjoy respectively, if there was no cooperation. They might be thought of as the payoffs associated with the solution to a non-cooperative game. John Nash referred to this set of payoffs as the "Threat Point", as they represent the *minimum* payoffs, which each of the two players must receive for the solution to a cooperative game to be stable (Nash, 1953).

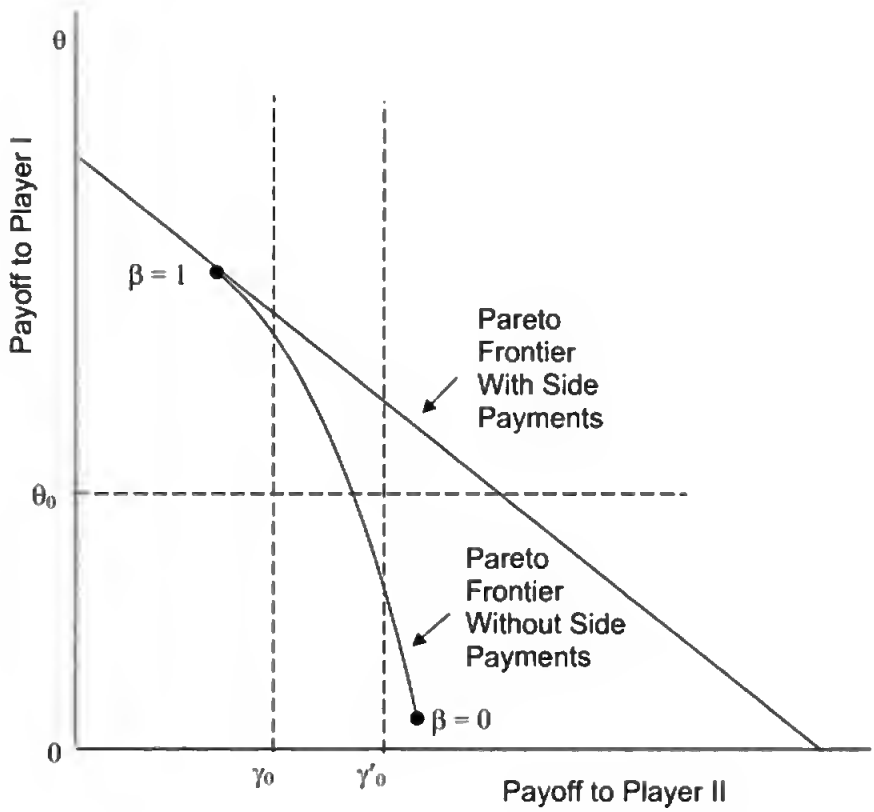
That part of the Pareto Frontier segmented by the dashed lines emanating from the Threat Point payoffs represents the "core" of the game. In the example shown, the "core" is positive, so that a stable solution can be achieved. We shall not discuss the theory underlying the determination of the ultimate solution (see: Nash, 1953). It will only be noted that a unique solution does exist, and that, in this example, the management preferences of both players will play a role, i.e. the solution β lies between 1 and 0. A solution, in which the management preferences of either player are wholly dominant, is not feasible. If, for example, the solution to the game was such that $\beta = 1$, the "solution", the cooperative agreement, could not last, since player II would be worse off than it would be, had it refused to cooperate.

Turn now to Figure 2. In this figure, allowance is made for the possibility of side payments.

When side payments (transfers) are allowed, a particular player's returns from the fishery are not dependent wholly upon its fleets harvest of the resource within its own waters. The Pareto Frontier in this case becomes a 45^0 line, which is tangent to the Pareto Frontier Without Side Payments, at the latter's highest point. The significance of the 45^0 line is that, at any point on the line, the sum of I and II's solution payoffs is equal to the sum of those payoffs at any other point on the line. The implication of all of this is that the players seek to maximize the global returns from the fishery, without regard for differences in management objectives. Bargaining then takes place over the division of the global returns.

It is at this point that a key question must be raised, the question being what benefits from the fishery are in fact being divided between the coastal states sharing the resource. Is it harvested fish per se, or is it the economic (and perhaps social) benefits arising from the fishery? If it is the latter, then sharing the harvest must be seen as only one of several ways of sharing the economic benefits from the fishery. If the relevant coastal states insist that the benefits be divided through harvest shares alone, then they are imposing a constraint upon themselves, a constraint, which in some instances, could prove to be crippling. Side payments serve to relax the constraint.

Figure 2. Cooperative Game With, and Without, Side Payments



Side payments become truly significant when the management goals of the coastal states sharing the resource differ. This author has argued that, when there are differences in management goals, it is invariably the case that one player places a higher value on the fishery than does the other. It might, for example, be that one player has lower harvesting costs than does the other, or it may be that one player discounts the future economic returns from the resource less heavily than does the other. When side payments are possible, then the optimal policy is one in which the management preferences of that player placing the highest value on the resource should be given full reign. That player should, in turn, then proceed to compensate (bribe some might say) its fellow player, or players, through the use of side payments. The side payments can take any number of forms. In another context, I referred to this as the *Compensation Principle* (Munro, 1987).

Consider Figure 2, yet again. In this example, player I places the highest value on the resource. The Pareto Frontier With Side Payments is tangent to the other Frontier at the point where $\beta = 1$, i.e. at the point where the management preferences of I are wholly dominant. The implication is that the global economic returns from the resource through time will be maximized by allowing player I to manage the resource, unimpeded by the management preferences of player II. Player I will then have to compensate player II through side payments, i.e. transfers of some form.

Ignore, for the moment, the payoff γ'_0 on the horizontal axis. II will obviously be better off with side payments, than without. What about I, however? Figure 2 shows that the introduction of side payments makes it possible for *both* players, I, as well as, II, to be better off than they would be in the absence of side payments. In the example, a solution to the game at which $\beta = 1$ is not feasible in the absence of side payments. We would have to end up farther down the Pareto Frontier Without Side Payments curve, with the consequence that the global benefits from the fishery would be less than the maximum. With side payments, the global maximum is achievable, to the mutual benefit of I and II.

Examples of side payments, in various forms will arise in the brief case studies to be considered at a later point. The most striking example, however, comes from an earlier case involving the fur seal fishery in the Northeast Pacific, early in the 20th century. The fishery was shared by four countries, Canada, Japan, Russia and the United States. When the fishery became significant in the late 19th century, there was no cooperative management. The "Prisoner's Dilemma" played itself out, and the resource was subject to severe overexploitation. Fearing the outright collapse of the resource, the four countries came together and transformed the non-cooperative game into a cooperative one, which took the form of the 1911 Convention for the Preservation and Protection of Fur Seals, which was to last, with one lengthy hiatus, until 1984.

The four players were not identical. Two, Russia and the United States, were low cost harvesters, harvesting the seals on land (Pribilotf Islands), while the other two, Canada and Japan, were high cost harvesters, harvesting the seals at sea. Moreover, Russia and the United States received higher prices for their harvested pelts, than did the other two countries. Needless to say, Russia and the U.S. placed a higher value on the resource than did the other two. Under the terms of the Convention, Canada and Japan agreed to reduce their harvests to zero. In return, they were promised by Russia and the U.S. a certain percentage of the annual harvested pelts. The annual transfer of pelts was a straightforward side payment, or compensation. The cooperative game proved to be profitable for all four players. Moreover, it also had beneficial conservation consequences. It was estimated that, between 1911and 1941 (when the hiatus in the Convention, referred to earlier, commenced), the seal herds had increased eighteen fold (FAO, 1992).

Returning once more to Figure 2, we now note that the figure shows two alternative cases. In the first case, the Threat Point payoff for II is γ_0, while in the second case II's Threat Point payoff is γ'_0 . In the first case, it would be possible to achieve a stable solution to the cooperative game, without side payments. The introduction of side payments has the effect making everyone better off, by allowing superior management. In the second case, if side payments are disallowed, then there is no solution to the cooperative game, because there is no point on the relevant Pareto Frontier at which both I and II would be better off than if they refused to cooperate. The "core" of the game is empty. With side payments, the scope for bargaining is increased, and a stable solution to the game is achievable. Thus, in the second case, side payments make the difference between a successful cooperative arrangement, and attempts to achieve cooperation ending in certain collapse.

An example is provided by the Norwegian Spring Spawning (Atlanto-Scandian) Herring fishery. The resource is managed cooperatively by Norway, Iceland, Russia, the Faeroe Islands and the EU. A recent empirical study on the fishery, conducted by a group of Icelandic economists, makes the point that the global benefits from full cooperation are very large indeed. The study, also concludes that, in the absence of side payments, a full fledged cooperative agreement will be inherently unstable (Arnason, Magnusson, and Agnarsson, 2000).

The *Compensation Principle*, although not labelled as such, found its way into FAO publications a decade ago. In FAO Fisheries Circular No. 853, *Marine Fisheries and the Law of the Sea: A Decade of Change*, 1992, for example, the author cites the case of the North Pacific Fur Seal Convention and states that:

> *The basic principle is the treatment of the fishery resources as resources that have value in situ; a value definable in monetary terms. The model is that of an international regime that achieves stability by the sharing of the benefits deriving from the use of the resource and providing compensation for those members who are less well endowed.* (FAO, 1992, p.41).

Next a comment about the sharing, or allocation, of the benefits arising from cooperative resource management and equity is in order. In the case of a two player game, the answer is straightforward. It is what we shall call the Nash Formula. The surplus arising from cooperation can be expressed as follows. Let the payoffs arising from the solution to the cooperative game be denoted as: θ^* and γ^*, and let the Threat Point payoff for II be γ_0 (i.e. Case 1). We can then say that:

Cooperation Surplus = $(\theta^* + \gamma^*) - (\theta_0 + \gamma_0)$

The Nash Formula is simply that the two players divide the Cooperation Surplus evenly. The rationale is that the two players should be seen as having made an equal contribution towards making cooperation possible. Hence, equity demands that they should share the Cooperation Surplus equally. If we denote the Cooperation Surplus as CS, then the Nash Formula would tell us that for player I, we would have:

$\theta^* = \theta_0 + 1/2\ CS$

Thus, player I receives its Threat Point payoff, plus one half of the Cooperation Surplus. What is true for player I, is true for player II[1].

If there are more than two players, then the issue becomes somewhat more complex, and a simple Nash type of formula less appealing. We shall comment further on this point, in the section to follow on straddling fish stocks.

In any event, the theory tells us that the allocation of the economic benefits from the fishery, be it in the form of harvests, or other forms, should be determined by the relative bargaining strength of the players, and equity, as perceived by the players. Hence, one cannot safely assume that simple mechanical formulae for allocations will prove to be satisfactory. Thus, for example, allocations based upon the fractions of the resource to be found in each player's EEZ, might seem to provide an eminently sensible basis on which to determine allocations. However, if the resultant formula leads to one player receiving a payoff less than its Threat Point payoff, then application of the formula will lead to the certain collapse of the cooperative arrangement.

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[1]This is not to say that the two players will share the total economic returns from the cooperatively managed fishery equally. Suppose, for the sake of argument, that 90 percent of the resource lies within player I's EEZ, with the remaining 10 percent in player II's EEZ. It is reasonable to suppose that player I's Threat Point payoff would be much larger than that of player II. Hence, player I's share of the total economic returns from the cooperatively managed fishery would exceed 50 *percent*, probably by an extensive margin.

Conditions for Stable Cooperative Arrangements: Some Further Considerations

The analysis, which we have examined up to this point, is good enough to get us started, but it is far from complete. Several other considerations have to be taken into account, of which the following two are of particular importance:

1) Non-binding arrangements
2) "Time consistency" of the arrangements

Up to this point, it has been assumed that, if it is possible for the players to enter into a cooperative resource management arrangement, the arrangement will be binding, and that it will, therefore, last forever. This raises the obvious question of what happens if the arrangement is non-binding. The game theoretic aspects then become rather challenging. The reader will be spared the details. Basically, one has to contend with two considerations, the first one being that of cheating. Cheating can be dealt with, if each player is capable of developing a set of credible threats. The object is to ensure that neither player finds that it pays to cheat (see, for example: Kaitala, 1985). When there are only two players involved, the development of credible threats is reasonably straightforward. If there are more than two, then developing credible threats becomes much more difficult, and when the number is large, quite possibly unachievable. This question, however, we leave for the section on straddling fish stocks.

Be that as it may, in the real world, regardless of how binding may be the arrangement, effective enforcement provisions are critical. It is difficult to argue with Gulland's statement that "----without adequate implementation and enforcement the best [fisheries] agreements ----can be useless." (Gulland, 1980, p. 17).

The second consideration is what has been termed "time consistency". If the arrangement is not perfectly binding, then one must allow for the consequences of changes in the underlying conditions, and the fact these changes will, more likely than not, occur in an unpredictable manner. Gulland warned of this possibility in his now much cited 1980 paper.

The chief consequence is that, what may have appeared to have been a perfectly sound and equitable arrangement at the time of initiation, will cease to be so. In terms of Figures 1 and 2, one way to illustrate this problem is to ask what the consequences will be if the Threat Point shifts over time, due to changing conditions, given that the arrangement is non-binding. Kaitala and Pohjola (1988), presented a formal analysis of such case, and showed how cooperative arrangements, meeting all of the requirements for stability outlined in the previous section, can collapse when confronted with changing conditions over time. Cooperative arrangements that cannot withstand the impact of changing conditions through time are said to be "time inconsistent".

It is difficult to overstate the importance of "time consistency", and the concomitant problem of uncertainty. There is probably no binding, let alone non-binding, fisheries arrangement, which is immune to pressures arising from conditions shifting in an unpredictable manner. An example is provided by the cooperative management of Pacific salmon by Canada and the United States, to which we referred earlier. The arrangement is contained within a formal treaty between the two countries (Treaty, 1985), and is consequently about as binding a cooperative arrangement, as one could ask for.

It will be recalled that the Treaty came into force in 1985, and that it appeared to work well for several years. It then broke down, with potentially grave consequences for the resource. While several factors led to the breakdown, unquestionably one very significant factor was an unpredicted, and unpredictable, climatic shift, which had a negative impact upon salmon resources in the southern area covered by the Treaty, and a positive impact upon such resources in the northern area. The Treaty proved, in the end, to lack the flexibility and robustness to withstand the stresses created by the unexpected climatic shifts (Miller, *et al.*, 2001).

Making a fisheries cooperative arrangement "time consistent" thus means ensuring that the arrangement is robust. Anything, which undermines the flexibility of the arrangement, undermines its robustness. Rigid, unyielding harvest sharing agreements are, in of and by themselves, for example, undesirable. One might add that the need for robustness enhances the importance of side payments, since side payments can increase the scope for bargaining, and thus enhance the flexibility of the arrangement.

A third issue, to which we have alluded, is that of many players, i.e. more than two players. While the issue does arise in the management of transboundary fish stocks, it is of particular importance to the management of straddling fish stocks. We do, therefore, defer the discussion of this issue until the section to follow.

As a final comment, we point out that the model described has now been used in empirical studies, outside of academia. The aforementioned World Bank study by Agüero and Gonzalez is one example. The authors use the model to explore, and to assess, alternative options available to Chile and Peru for cooperative management of shared small pelagic fishery resources (Agüero and Gonzalez, 1996).

A REVIEW OF THE BASIC ECONOMICS OF THE MANAGEMENT OF STRADDLING FISH STOCKS

We turn now to the economics of the management of straddling fish stocks. In so doing, we look to the 1982 UN Convention (UN, 1982), and the 1995 UN Fish Stocks Agreement (UN, 1995) for the relevant legal framework. It is, of course, recognized fully that the implementation of the UN Fish Stocks Agreement is at an early stage.

Be that as it may, under the terms of the UN Fish Stocks Agreement, straddling stocks are to be managed cooperatively, on a sub-region by sub-region basis, through Regional Fisheries Management Organizations (RFMOs), which will count among their members distant water fishing nations (or entities) (DWFNs, hereafter), as well as coastal states. Obviously, there is no question that, in the economic analysis of the management of these resources, game theory must be employed. We now confront strategic interaction between/among coastal states *and* DWFNs.

As noted at an earlier point, the economic analysis of the management of straddling fish stocks rests upon a foundation provided by the economic analysis of transboundary fish stocks. The question to be asked is what modifications, if any, must be made to the economics of transboundary fish stock management, in order to accommodate the particular characteristics of straddling fish stocks.

One part of this question can be answered quickly. The economic analysis of the non-cooperative management of straddling fish stocks differs not at all from the economic analysis of the non-cooperative management of transboundary fish stocks. Except in unusual circumstances, non-cooperative management of straddling fish stocks will lead to the resources being mismanaged from society's point of view , and will do so for exactly the same reasons that non-cooperative management leads to the mismanagement of transboundary fish stocks – the "Prisoner's Dilemma" once again.

The pollock resources of the Bering Sea high sea enclave, the Doughnut Hole, which were subject to non-cooperative management prior to 1992, provide an example. It is reasonable to say that, prior to 1992, the resources were not just overexploited; they were plundered (Balton, 2001; FAO, 1994). Indeed, it can be argued that the overexploitation of straddling (and highly migratory) fish stocks worldwide, which provided the motivation for the convening of the UN Fish Stocks Conference, bears testimony to the predictive power of the economic analysis of the non-cooperative management of such resources (Munro, 2000).

It is in cooperative management that distinctions between straddling and transboundary fish stocks appear. There are three features distinguishing the cooperative management of straddling fish stocks, from the cooperative management of transboundary fish stocks, which are particularly striking. They are:

1. Absolute Number of Participants: the number of participants in the typical cooperative transboundary fishery management regimes is relatively small. One can, in analysing the economics of the management of these resources, usually make do with two player models, as was emphasized in the previous section. In the case of straddling fish stocks, involving cooperation among coastal states and DWFNs, one must allow for the possibility that the typical RFMO will have a substantial number of participants. Restricting the economic analysis to two player models is simply not acceptable. Having said this, however, let it be conceded that this distinguishing feature is one of degree.

2. Nature and Number of Participants Through Time: in a cooperative transboundary fishery management regime, the nature and the number of participants can be expected to remain constant through time, except in the most unusual circumstances. In the case of a RFMO, some of the participants are DWFNs, the fleets of which are nothing, if not mobile. Thus, conceivably, a DWFN, originally participant in a RFMO, could withdraw. Of much greater importance, a DWFN, not a founding, or "charter", member of a RFMO may join at later stage. The UN Fish Stocks Agreement does, after all, make specific provision for New Members (UN, 1995, Article 11). It is this feature, which probably most clearly distinguishes the cooperative management of straddling fish stocks from transboundary fish stocks (Munro, 2000).

3. Exploitation of the Resource(s) by Entities Not Party to the Cooperative Arrangement: in the case of a transboundary resource, any attempt by a non-member of the cooperative arrangement to exploit the resource(s) in the EEZ of a member of the arrangement, without the express permission of that member, would clearly be illegal. The member could take vigorous measures to repel the intruder (see: FAO International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU, hereafter), 2001, para. 3.1.1). In the case of a straddling stock a state, or entity, which is a non-member of the RFMO, found to be fishing the stock in the high seas governed by the RFMO, in a manner inconsistent with the conservation and management measures of the RFMO, would be deemed to be engaging, not in illegal fishing, but rather in *unregulated* fishing (IPOA-IUU, 2001, para.3.3.1). The action, which the members of the RFMO could take to deal with the unregulated fishing, is less clear than the action, which they could take if confronted with illegal fishing. The IPOA-IUU attempts to address this problem. It will be argued that, how this issue comes to be addressed in the future, will have a significant impact on the sustainability of the RFMO regime, through time.

Number of Participants, or Members

When the number of players in a fisheries game is large, one has to be concerned with the possibility, as before, of complete non-cooperation, of players competing with one another on an individual basis. One has also to be aware, however, with the possibility of partial cooperation, of players forming sub-coalitions, and of those sub-coalitions then competing with one another. The full benefits of cooperation are, of course, achieved, when the players form a single coalition, referred to as the Grand Coalition. In order for the Grand Coalition to be stable, it is not enough that each individual player receive a payoff at least as great as it would under competition. There must, in addition, be assurance that no sub-coalition would be better off by standing on its own, and refusing to cooperate with the rest.

In passing, another complication arises from the division of the returns from cooperation. The most widely accepted formula does not involve an equal division of the cooperative surplus among the players, as in two player games. Rather the division is based upon the average of each player's marginal contributions to all possible coalitions, and thus reflects more accurately the relative bargaining power of the players, than would a simple equal division of the cooperative surplus (Kaitala and Lindroos, 1998). It is commonplace to observe, as noted an earlier point, that the larger are the numbers, the more difficult it is to achieve a stable cooperative regime. There is, however, one example, of cooperative fisheries management, involving large numbers, which has proven to be remarkably successful. The case involves the management of transboundary, rather than straddling, fishery resources, and is the exception to the rule that transboundary fishery cooperative arrangements usually involve small numbers. The example is introduced at this stage, because it is likely to hold lessons for the management of straddling, as well as transboundary, fishery resources.

The example consists of the independent Pacific Island Nations, which entered into a cooperative management arrangement for tuna, through the establishment of the South Pacific Forum Fisheries Agency (FFA), in 1979. Fourteen independent Pacific Island Nation "players" were then involved. It can be argued that this arrangement represents one of the most successful attempts at cooperative fisheries management in the world.

Initially, however, there were serious doubts that the endeavour could succeed. A cooperative fisheries "game", consisting of fourteen players, which were spread over a wide geographical area, and many of which were at low levels of development, appeared to be intractable. For the first few years of the FFA's existence, the pessimism seemed to be fully justified (Munro, 1982;1991).

In the end, the cooperative endeavour did succeed. In part, this is due to the fact that the fourteen coalesced into two sub-coalitions, which appears effectively to have turned the game into a de facto two player game. There is also clear evidence of side payments between the sub-coalitions being brought into play, although, needless to say, the term "side payment" was never used in the region (Munro, 1991.).

The New Member Problem

With respect to the issue of New Members, it is this author's understanding that the founders of a RFMO, what we might term the "charter" members, can, under the terms of the UN Fish Stocks Agreement (Articles 8, 10 and 11), exclude would be New Members, claiming a "real interest" in the fishery(ies), only if the would be New Members refuse to abide by the terms of the RFMO management regime (see, as well, the following article by three specialist in the Law of the Sea: Orebech, Sigurjonsson and McDorman, 1998). Otherwise, the prospective New Members are to be admitted. Orebech *et al.* (1998) argue further that such New Members "must be offered *just and reasonable* shares of the TAC available under an [RFMO] management plan" (Orebech *et al.*, 1998, p. 123).

The question of the terms and conditions, under which New Members are to be admitted, including, *inter alia*, what constitutes *just and reasonable* shares of the TAC, is of direct relevance to the economics of the management of straddling stocks. The reason is simple. The terms and conditions can affect the stability of the cooperative management regime.

Several years ago, Kaitala and Munro (1997) demonstrated the following. If *just and reasonable* implies that New Members, upon joining a RFMO, should receive, at no further cost as it were, shares of the Total Allowable Catch, or the equivalent, on a pro-rata basis, then, when planning is undertaken for the establishment of a RFMO, prospective "charter" members could well calculate that their expected payoffs from cooperation would fall below their respective Threat Point payoffs. Hence, the RFMO would be stillborn.

The aforementioned interpretation of *just and reasonable* poses the threat described, because it may give rise to a type of "free rider" problem. It is a "free "rider" problem, let it be stressed, which has nothing whatsoever to do with cheating, with flouting the provisions of the RFMO management regime.

The Kaitala-Munro argument can be explained in terms of the following example. Suppose that a hitherto overexploited straddling stock comes under the management of a RFMO consisting of coastal state V, and three DWFNs, W, X, and Y. The four "charter" members undertake the cost and sacrifice of rebuilding the resource over, let us say, a seven year period. In the eighth year, the four are in a position to enjoy a return on their resouree investment, through harvesting. At the beginning of the eighth year, a prospective new member, DWFN Z, appears. It demands access to the RFMO, agrees to abide by the resource management rules, but demands, "free of charge", a share of the harvest, and by implication, a share of the net economic returns from the fishery. If DWFN Z's demands were acceded to, Z would effectively be a "free rider." Having incurred none of the costs and sacrifices of investment in the resource, it will enjoy, at no cost, a share of the return on the investment. If "charter" members of a RFMO anticipate extensive "free riding" of the form described, then a straightforward application of game theory demonstrates that one, or more, "charter" members may conclude that it (they) would be better off by refusing to cooperate (Kaitala and Munro, *ibid.*).

Kaitala and Munro (1997) did not discuss the case in which the "charter" members establish a RFMO, expecting the appearance of no New Members, but are then subsequently unpleasantly surprised. Nonetheless, their analysis could readily be extended, and an outcome predicted. The RFMO would be established and might well appear to be successful, initially. When the unpleasant surprise occurs, however, the "charter" members could be expected to reassess their expected payoffs from cooperation, with the possible consequence that the RFMO would disintegrate.

The question, as yet unresolved, is how to ensure that the provisions of the UN Fish Stocks Agreement, pertaining to New Members, are honoured, without at the same time undermining the long term stability of

the RFMOs. This paper will not attempt to offer possible solutions, but will respectfully suggest that it is a question, which should be addressed, in detail, during the Expert Consultation.

As an addendum to this section, we raise a further issue, which in terms of the economics, can have consequences similar to that of the New Member problem. This issue pertains to the "real interest", which states and entities have to fisheries governed by a particular RFMO.

As is well known, Article 8(3) of the Agreement states that "---States having a real interest in the fisheries concerned may become members of such organizations [i.e. RFMOs]" (UN, 1995). The term "real interest" is not defined in the Agreement. The Dutch legal expert, Erik Molenaar, (Molenaar, 2000) argues that states/entities having a "real interest" in the relevant fisheries can be taken to include the following categories:

(a) coastal states and DWFNs currently engaged in active exploitation of the fisheries

(b) DWFNs, which are not currently engaged in exploiting the fisheries, but which had done so in the past, and which would now like to re-enter the fisheries.

(c) DWFNs, which had never exploited the fisheries, but which would now like to do so.

Article 8(5) of the Agreement, discusses the establishment of new RFMOs. The paragraph calls upon states falling within Category (a), alone, to commence the establishment. Article 9(2) states that "States cooperating in the formation of a ---regional fisheries management organization [Category (a) states] --- shall inform other States which they are aware have a real interest in the work of the proposed organization [Category (b) and (c) states] ---of such cooperation" (UN, 1995). Molenaar maintains that one can infer from all of this that, upon so informing such Category (b) and (c) states, the Category (a) states would then invite their (b) and (c) colleagues to enter the RFMO negotiations (i.e. become "charter" members) (Molenaar, 2000, n.80). Undoubtedly, the Molenaar position is not accepted by all.

If the Agreement is interpreted, over time, to mean that Category (b) and (c) states must be invited to become "charter" members, then it is easy to see that the same sort of "free rider" problem, threatened by the New Member issue, can readily arise. Return to our New Member problem example, discussed earlier. Now suppose that states V, W, X, and Y are Category (a) states. Suppose, further, that Z is now a Category (c) state, which demands and receives full and undiluted "charter" membership. Z incurs no real sacrifice in the re-building of the resource, because it had not hitherto been engaged in harvesting the resource. Z will simply bide its time over the seven year period, and then, when the eight year arrives, will come to enjoy a share of the return on the resource investment, as the "free rider" that it most certainly is. Once again, the possibility of such "free riding" could undermine the viability of the RFMO.

Unregulated Fishing

Fishing by non-members in the high seas area governed by a RFMO, in a manner contrary to the RFMO management regime, comes under the heading of unregulated fishing. Unregulated fishing can be seen as another form of "free riding". If it is uncontrolled, then it is easy to show, with the aid of game theory, that its existence, or threatened existence, can serve to undermine RFMOs. In a way, it is like a particularly virulent form of the New Member problem.

One can also show, with the aid of game theory that, if the only way that unregulated fishing can be controlled is by persuading the non-members to join the RFMO voluntarily, the stability of the RFMO will be in serious doubt. Recent work has shown the number of players, which a Grand Coalition is likely to be able to support under these circumstances, is depressingly small (often no more than two). With a large number of players, defection, "free riding", becomes too easy, and too attractive. If on the other hand, effective punishment can be meted out to those who refuse to desist from unregulated fishing, then, not surprisingly, the likelihood of achieving a stable cooperative agreement, with large numbers, is greatly enhanced (see, for example: Pintassilgo, forthcoming; Lindroos, 2002).

In the case of straddling stocks, "large numbers" can be expected to be the rule, not the exception. The implications are obvious. If the RFMO regime is to be sustainable through time, effective implementation of the FAO IPOA-IUU is mandatory.

A PostScript

Suppose now that one is examining the economies of the management of a RFMO, the members of which are few in number, and had all been actively engaged in the relevant fisheries at the time of the founding of the RFMO. Suppose further that it is confidently believed, within the RFMO, that the issue of New Members, and the threat of unregulated fishing, are unlikely to arise in the foreseeable future. Then the economic analysis applied to the cooperative management of transboundary fishery resources can be applied with little or no modification.

A case in point is provided by the economics of the management of the Norwegian Spring Spawning Herring. The resource, which has both transboundary and straddling attributes, and which is managed cooperatively by four countries and one entity, has been studied extensively by economists (primarily Scandinavian) over the past few years. Most of these economists assume that the cooperative management regime for the resource is fixed in terms of membership, and is free from the threat of unregulated fishing. They use models, which are but variants of those applied to the study of transboundary fishery resources (see, for example: Arnason, Magnusson and Agnarsson, 2000; Bjørndal, Gordon, Lindroos and Kaitala, 2000).

SOME COMMENTS ON THE INSTITUTIONAL ASPECTS OF COOPERATIVE SHARED FISH STOCK MANAGEMENT

This will be a very brief section indeed. The truly useful information on appropriate institutional arrangements can be expected to arise from discussions, and the case studies to be presented, at the Expert Consultation.

Be that as it may, the one paper, which goes into the institutional aspects at greatest depth, is the 1997 John Caddy paper. Let it be conceded that the paper has the limitation, from the perspective of the Expert Consultation, of not discussing RFMOs explicitly.

The first question raised by Caddy is whether a formal body for effecting cooperation is required, or whether an informal committee type of structure will suffice. Caddy points out that formal bodies will often prove to be expensive, and may be seen as a threat to the sovereignty of prospective participants in the cooperative undertaking. There is no clear response that one can give to this question, other than to make the obvious, and rather vague, statement, that in some cases the cooperative management problem is simple enough that an informal committee will do, while in other cases, the complexities involved demand a formal structure. Thus, for example, Canada and the United States co-manage a hake (whiting) resource off their respective Pacific coasts, and find no need to do so on other than on an informal basis. On the other hand, it seems inconceivable that the Pacific Island Nations could effect cooperative management of their immense tuna resources on an informal basis. No one questions that the formal coordinating body, the Forum Fisheries Agency, has, and does, play a critical role. Similarly, it seems inconceivable that the straddling stocks managed under the Northwest Atlantic Fisheries Organization (NAFO) could be managed other than through a formal organization.

The Caddy paper does, however, have a point, under the heading of institutional issues, of considerable substance. The point pertains to scientific cooperation. The point was made earlier that cooperation in research, divorced from resource management, should be relatively easy to achieve (Gulland, 1980), but that once cooperation in research and management become intertwined, research can become a focus of conflict and discord. One example is provided by Pacific salmon. A key factor in the management of the resources, and one, which affects the returns to the players, is the estimated current abundance of various salmon species and stocks. Millar, *et al.* (2001), in commenting on the future of the 1999 Agreement, designed to repair the treaty governing the co-management of the resource, state that "-----one of the most pressing needs will be to find a way to prevent the parties from turning abundance estimates into tools of combat" (Miller, *et al.*, *ibid.*, p.47).

Caddy argues that one way out of such difficulties is to have the scientific research subject to independent reviews. One can, in fact, find examples of where such independent scientific advice is employed. One of the more successful cooperative resource management regimes is to be found in the Barents Sea, involving two players, Norway and Russia. The two players, when negotiating the TACs for the fishery resources within their management purview, turn to ICES for independent scientific advice. ICES does, as well, provide advice in support of other international fisheries agreements in the Baltic and the North Atlantic (e.g. that pertaining to Norwegian Spring Spawning Herring) (Nakken, Sandberg and Steinsham, 1996).

SOME SELECTED CASE STUDIES

We turn now to a few case studies, several of which have already been referred to in passing, in order to provide some further illustrations of points made in earlier sections. The case studies will be in the nature of very brief sketches, rather than detailed descriptions. An important reason for brevity is that, at the time of writing, it is anticipated that all of the cases discussed here will be presented as complete case studies at the Expert Consultation.

(a) Pacific Island Nations Tropical Tuna Fisheries

The Pacific Islands Region constitutes one of the richest tropical tuna grounds in the world. The tuna resources were, and are, of fundamental economic importance to the Islands. Consequently, it could be maintained that the Pacific Island Nations were, collectively, one of the big "winners" from the advent of Extended Fisheries Jurisdiction (EFJ), in 1982. Having said this, however, it was not at all clear at the time that the economic benefits, which these countries would enjoy from EFJ would be other than ephemeral.

Collectively, the Pacific Island Nations EEZs covered an immense area of 29 000 million km^2, while their collective land mass was but 500 000 km^2. Most of the tuna harvests, within these EEZs, 80 percent or more, were taken by DWFNs. Finally, the Pacific Island Nations were generally at low levels of development. Hence, these countries faced what appeared to be insurmountable monitoring and surveillance problems.

These difficulties were compounded by the following. First, the Pacific Island Nations effectively faced but one DFWN, one that was a major power in the Asia Pacific region. As a provider of harvesting services, this powerful nation was in the position of a monopolist within the Pacific Islands Region. Secondly, the right of coastal states to assert management jurisdiction over tuna resources was bitterly contested at the close of the UN Third Conference on the Law of the Sea.

The Pacific Island Nations had an incentive to cooperate. Without cooperation, it was inevitable that the single DWFN would play one Island country off against the other, and that it would do successfully (Munro, 1991). Achieving effective cooperation was, however, very difficult.

We have already noted that the Island nations attempted to cooperate through the formation of the Forum Fisheries Agency (FFA), and have discussed the difficulties to be encountered in attempting to achieve a stable cooperative outcome, when there are large number of players. It will also be recalled that there were fourteen countries involved, which varied enormously in size, and which were spread over vast distances. This author, writing in 1981, expressed the then general pessimistic view about the future viability of the FFA (Munro, 1982).

The tuna resources in the South Pacific are not evenly spread, tending to concentrate around the Equator. The consequence is that there are, in relative terms, "haves" and "have nots", among the Pacific Island Nations. Seven of the fourteen could be regarded as "haves". Concerned about the lack of progress in the FFA, the seven met on the island of Nauru (one of the seven) and signed a formal agreement, the Nauru Agreement, and became known as the Nauru Group thereafter. The Nauru Group made it known, that, while the Group had no wish to see the FFA disintegrate, the Group would go it alone unless the others engaged in serious cooperation. The others decided that serious cooperation was indeed in their best interest.

In the discussion of cooperative games with many players, it was pointed out that, in such games, the formation of sub-coalitions is a common occurrence. In the case of the FFA countries, two sub-coalitions

were thus formed, the Nauru Group ("haves"), and the "have nots"". It helped that there are two major Island nations, Papua New Guinea (PNG) and Fiji, which were in different sub-coalitions. PNG was in the "haves" sub-coalition, and became its leader; while Fiji became the leader of the "have nots" sub-coalition. An intractable fourteen player game had evolved into what amounted to a two player game (Munro, 1991).

Not surprisingly, the management goals of the two sub-coalitions were not the same. The Nauru Group was much more concerned about the long term stability of the resources, than the less well off sub-coalition. Clearly, the Nauru Group placed the higher value on the resource. The theory tells us that the optimal outcome would be for the management preferences of the sub-coalition placing the higher value on the resource to be made dominant, and for that sub-coalition to compensate its fellow subcoalition.

The predictive power of the theory in this instance proved to be strong. The Nauru Group became the cutting edge in terms of formulating management policy. Various forms of side payments emerged, through which the "have not" sub-coalition was compensated (Aikman, 1987; Munro, 1991). These compensations continue up to the present day. Moreover, the "have nots" sub-coalition has played an increasingly important role in the cooperative management of the resource (David Doulman, personal communication), which attests to the growing strength of the cooperative resource management arrangement.

(b) Pacific Salmon - Canada and the United States

Wild Pacific salmon, as an anadromous species, are produced in fresh water, spend most of their lives in the ocean, and then return to their fresh water origins to spawn and die. In Pacific North America, wild salmon are produced in rivers and streams from California through Oregon, Washington, British Columbia, to Alaska. Historically, the two single most important salmon river systems have been the Columbia, primarily (but not exclusively) in the United States, and the Fraser, wholly confined to Canada.

Some American produced salmon are inevitably "intercepted," i.e. caught, by Canadian fishers; some Canadian produced salmon are inevitably "intercepted" by American fishers. Hence, the resource is inescapably transboundary in nature. The fish are normally harvested as they approach river mouths on their way to the spawning rounds. They are easy to catch, and thus highly vulnerable to overexploitation. Hence, the consequences of non-cooperative management of the resource can be severe.

Canada-United States Pacific salmon negotiations, initially focussed on the Fraser River, did in the early 1970s, become broadened, with the objective of covering all salmon produced from northern California to southern Alaska. The negotiations proved to be extraordinarily difficult. The negotiators were, however, spurred on by the threatened emergence of a "fish war," which both sides realized would be highly destructive, and by the blocking of enhancement projects on both sides of the border(Munro and Stokes, *ibid.*).

In 1985, the Canada-United States Pacific Salmon Treaty came into being (Treaty, 1985). The division of returns from the fisheries was incorporated in the Treaty, in the so called Equity Principle, in which each country was to receive economic benefits commensurate with the salmon produced in that country's rivers and streams. Achieving equity was to be through balancing interceptions alone. No thought was given to the possibility of side payments.

At the time that the Treaty was signed, the Fraser and Columbia Rivers were seen as being at the heart of the cooperative resource management agreement. The Americans intercepted primarily Fraser River salmon; the Canadians intercepted primarily Columbia River salmon. Alaska was essentially a "side show." The intereceptions appeared to be roughly balanced (Munro and Stokes, 1989). Initiatly, the cooperative agreement prospered. While no actual estimates were made, it was agreed that if the Cooperative Surplus, were to be measured, it would prove to be very large indeed.

There were, however, two problems, which were to emerge over time. The first was that, while Canada could be viewed as a single player, the United States was in fact a not particularly stable coalition, in which Washington/Oregon and Alaska were key players. The second problem arose from the fact that a climatic shift was then under way in 1985, which was to prove detrimental to salmon stocks in Washington, Oregon and southern British Columbia, but highly beneficial to salmon stocks in Alaska (Miller *et al.*, 2001).

The impact of the climatic shifts became increasingly evident over time. The Columbia River salmon showed signs of severe deterioration, which led, in turn, to declining Canadian interceptions. The booming Alaskan stocks, in turn, resulted in increased Alaskan interceptions of Canadian produced salmon, as Alaskan fishers sought to reap their bounty. Alaskan interception, initially minor from a Canadian perspective, achieved greater and greater importance (Miller, *et al.*, *ibid.*).

The rough interception balance of the early years of the Treaty was upset. The Alaskans were pressed to reduce their interceptions, which they insisted that they could do only by forgoing their bounty (Miller, *et al.*, *ibid.*). By 1993, the Treaty was in disarray. A very real threat of a "fish war," i.e. reversion to destructive competitive behaviour, loomed (Miller, *et al.*, 2001). A fundamental condition for cooperative resource management had now been violated. The Individual Rationality Constraint had become binding. A major player, Alaska, was no longer better off with the Treaty, than without.

The Pacific salmon case illustrates the paramount importance of flexibility and "time consistency" in cooperative fisheries management agreements. As was noted at an earlier point, the Canada-United States Pacific Salmon Treaty was as binding an agreement as one could hope to achieve. Yet, the Canada-U.S. Pacific salmon cooperative game had proved to lack the resilience needed to accommodate changing conditions. The harvest allocation mechanism set in place by the Treaty effectively broke down. One might add that a significant factor, underlying the lack of resilience, and noted by an increasing number of observers, was the absence of the possibility of side payments (Miller, *et al. ibid.*).

In 1999, Canada and the United States signed an Agreement in an attempt, initially successful, to restore cooperation (United States, 1999). It is too early, at this stage, to determine whether the Agreement will lead to a lasting peace, or whether it will prove to be no more than a temporary truce (Miller, *et al.*, *ibid.*). The issue is certain to be discussed in detail at the Expert Consultation in the presentation of the expected case study on Pacific salmon.

(c) Norwegian Spring Spawning Herring Fishery

The Norwegian Spring Herring stock is among the largest and biologically most productive fishery resources in the world. When healthy, the resource has total biomass of 15 to 20 million tonnes, and a spawning biomass averaging 10 million metric tonnes (Arnason *et al.*, 2000). The resource, when in a healthy state, is both a transboundary and straddling stock. The resource, as the name would suggest, spawns in Norway. After spawning, the resource migrates from the Norwegian EEZ through the EEZs of the EU, the Faeroe Islands, and Iceland. The resource does, as well, migrate through a large high seas enclave known by some as the "Ocean Loop", and by others as the "Herring Loop" (Arnason *et al.*, *ibid.*, Bjørndal and Gordon, 2000). When depressed, the resource is confined to Norwegian waters (Bjorndal, Hole, Slinde and Asche, 1998; Arnason, *et al.*, *ibid.*).

The resource has the characteristic, typical of clupeoids, of being an intense schooling species, and is thus highly vulnerable to overfishing. In the pre-UN Third Conference on the Law of the Sea era, the fishery was an international open access one. The economic models of non-cooperative management of shared fish stocks proved, by the late 1960s, to have powerful predictive power. The resource collapsed, due to overexploitation, and came within a hair's breadth of extinction (Arnason, *et al.*, *ibid.*). An international moratorium was declared in 1969.

Through the good fortune of an exceptionally strong year class appearing in the late 1980s, and the continuing harvest moratorium, the resource recovered. The spawning biomass recovered to the healthy state level of 10 million metric tonnes, and the moratorium was lifted. It was recognized that cooperative management of the resources was required, if the health of the resource was to be maintained.

Five countries/entities exploiting the resource - originally Norway, Iceland, Russia, the Faeroe Islands, and later the European Union (EU) – came together in the mid-1990s to establish a cooperative resource management arrangement. The initial attempt to establish cooperative resource management was disappointing (Bjørndal, Hole, Slinde and Asche, 1998). By 1996, however, the cooperative resource management regime achieved stablity and has apparently remained successful up to the present time. It can

be argued that, after December 1995, the UN Fish Stocks Agreement provided the framework required for a successful cooperative resource management regime.

It can be noted in passing that the Norwegian Spring Spawning Herring case provides us with an example of the inadequacy of simple formulae for allocation of benefits from the fishery among the players. There was some suggestion at an early stage of the negotiations that so called "biological zonal attachment" (determined by the amount of the biomass in each EEZ, and high seas zone, and the amount of time spent by the biomass in each EEZ, and high seas zone) be given substantial weight in setting quota shares among the five. Heavy emphasis on "biological zonal attachment" would have given the EU a negligible quota share (Bjorndal, Hole *et al.*, 1998). The EU's bargaining strength was(is) such that its quota share was not, and is not, negligible.

In any event, the incentive to cooperate is strong. It is obvious to all players that the Cooperative Surplus is large, particularly because a reversion to competitive behaviour would carry with it the distinct threat of extinction of the resource (Arnason, *et al.*, *ibid.*). There also seems to be some signs of "time consistency", although the cooperative arrangement has not been in place long enough to provide convincing evidence. Nonetheless, it is recognized that the migratory pattern of the resource is certain to vary over time, and that this will necessitate renegotiations of the quotas (Arnason, *et al.*, *ibid.*). Finally, the cooperative resource management regime has not been tested with respect to New Members, nor is there any likelihood that such testing will arise in the foreseeable future.

Reference has already been made of the game theoretic analysis of the fishery by Arnason *et al.* and their conclusion that, in order for the Grand Coalition to be stable, side payments were essential (Arnason, *et al.*, *ibid.*). There is no evidence of monetary side payments having been made. There are, however, numerous "side arrangements" between players, for example allowing one player to take part of its quota in another player's zone, in exchange for various quid pro quo. To quote Bjørndal and Munro (2000):

> *Whether these side arrangements fit the precise definition of side payments may be open to debate. What is not open to serious debate is the fact that the side arrangements have the flavour of side payments, that they have added to the flexibility of the agreement, and that they have served to broaden the scope for bargaining.*

Norwegian Spring Spawning Herring presents us with what is likely to be the single most important case of straddling fish stock management to come before the Expert Consultation. It is to be hoped that the Expert Consultation will be given the opportunity both to learn, in detail, why cooperative management of the resource has proven to be so successful up to the present time, and to assess the relevance of this experience to the cooperative management of other straddling stocks.

(d) North East Arctic Cod Fishery

We follow with yet another Scandinavian linked example, namely the North East Arctic cod fishery. The resource extends from the west coast of Norway to the Spitzbergen and Novaja Zemliza islands, and has, historically, been the single most important cod stock to the Norwegian fishing industry.

The resource is shared by Norway, with Russia. A cooperative management arrangement was established between Norway and the then USSR in the mid-1970s. What is striking is how successful, and resilient, the cooperative management regime has been to date. When cooperation commenced, the two countries were firmly on opposite sides of the Cold War. The cooperative management regime has subsequently withstood the transformation of the USSR to the smaller Russia, and the upheavals, occurring in Russia from 1991 onwards.

By the beginning of the 1990s, a further complication was introduced. The resources became a straddling stock as well as a transboundary stock, by virtue of the fact that a significant amount of the resources moved into a high seas enclave, between the Norwegian and Soviet/Russian EEZs, known as the Loophole. This attracted the attention of DWFNs, and one DWFN in particular, Iceland. Extensive Icelandic fishing in the Loophole resulted in several years of acrimonious dispute. The dispute was settled, almost four years after the UN Fish Stocks Agreement had come up for ratification, in 1999. Under the terms of a tri-lateral

agreement, Iceland agreed to withdraw from the Loophole, in exchange for cod quota in the Norwegian – Russian EEZs (Stokke, 2001).

A study by Armstrong and Flaaten in 1991 showed the obvious basis for cooperation between Norway and the Soviet Union/Russia. Their study reveals that even though the cooperative regime was less than optimal, the Cooperation Surplus was massive, and that both players were unquestionably better off than they would have been under competition (Armstrong and Flaaten, 1991). A later article by Armstrong (1994) supports this conclusion. Although cod harvests have declined significantly in recent years, there is no reason to believe that the gains from cooperation remain other than substantial at the present time (Munro, 2000).

There are other aspects of the cooperative management arrangement, which add to its strength and resilience. Both the Armstrong and Flaaten and Armstrong papers (1991; 1994) give one the initial impression that the two players refused to consider the possibility of side payments, or the equivalent thereof. This author would suggest that the initial impression is not entirely accurate. First, there is evidence, provided, in fact, by the aforementioned authors, that arrangements have been made to allow U.S.S.R./Russian vessels to harvest part of their quota in the Norwegian EEZ.

Secondly, while the allocation of the TAC has been rigidly determined on a 50:50 basis, since the inception of the cooperative arrangement, the precedent has been set of Norway taking more than 50 percent of the TAC through quota "swaps." Norway surrenders part of its quotas in other fisheries, in exchange for a greater share of the North East Arctic Cod TAC (Armstrong and Flaaten, 1991). These two aspects imply added flexibility in the cooperative arrangement. Moreover the quota "swaps" fit all reasonable definitions of side payments, except the most narrow.

Finally, it is worth recalling our earlier comments to the effect that scientific research, certainly including stock assessments can become "weapons of combat" in fisheries management and allocation negotiations. Norway and Russia to their credit (as we noted earlier), do, when negotiating TACs, turn first to ICES for independent, and objective, scientific advice (Nakken *et al.*, 1996).

CONCLUSIONS

We are now in a position to draw certain conclusions. The first conclusion is that the management of shared fish stocks continues to be a major issue in world fisheries. There may exist as many as 1 500 transboundary fish stocks alone. One can only guess at the number of stocks to be added to this total, when straddling fish stocks are taken into account. Only a limited number of these shared fishery resources are subject to effective cooperative management. The scope for improved management is, therefore, immense.

The second conclusion is that, with few exceptions, cooperation in the management of shared fishery resources does matter. It is dangerous to assume that non-cooperative management of shared fishery resources will lead to resource management programs, which are adequate.

Cooperative management at the secondary level, involving full joint management, is, admittedly difficult and costly. Nonetheless, there do exist some examples of effective cooperative resource management, which can serve as examples for others.

Stability in cooperative resource management arrangements requires that certain requirements be met. Several of these requirements are obvious. First, for a given arrangement to be stable, it must not be possible to find an alternative arrangement, which is capable of making all "players" better off. Secondly, the so called "individual rationality" constraint must be satisfied. Even if only one "player", or subcoalition of "players", party to the arrangement, concludes that it can do better, by refusing to cooperate, the full cooperative arrangement will not hold.

Thirdly, where the number of participants in a cooperative management regime is large, it is imperative that the surrounding legal framework be found to have strength. Cooperative management arrangements, which purport to be binding, but which in fact are non-binding, are unlikely to survive the stress created by large numbers. Fourthly, in the case of straddling stocks, means must be found of accommodating New Members,

in accordance with the UN Fish Stocks Agreement, that do not, at the same time, undermine the long term viability of RFMOs.

A less obvious, but highly important, requirement, relevant to both transboundary and straddling fish stocks, is that the cooperative management arrangement be "time consistent". The cooperative management arrangement must have the flexibility and robustness to withstand through time the shocks of unexpected and unpredictable changes.

Ensuring that the individual rationality constraint is satisfied, and maximizing the robustness of the arrangement, requires, in turn, that the scope for bargaining be as great as possible. One means of so doing, stressed in this paper, is by making full use of side payments, broadly defined.

REFERENCES

Agüero, Max and Exequiel Gonzalez 1996. *Managing Transboundary Stocks of Small Pelagic Fisheries:* Problems and Options, World Bank Discussion Paper No. 329, Fisheries Series, Washington.

Aikman, C.C. 1987. Island Nations of the South Pacific and Jurisdiction Over Highly Migratory Species, *Victoria University of Wellington Law Review* 17: 101-124.

Armstrong, C.W. 1994. Cooperative Solutions in a Transboundary Fishery, *Marine Resource Economics* 9:329-351.

_____ and Ola Flaaten 1991. The Optimal Management of a Transboundary Resource: The Areto-Norwegian Cod Stock, in R. Arnson and T. Bjørndal (eds.), *Essays on the Economics of Migratory Fish Stocks*, Berlin, Springer-Verlag: 137-152.

Arnason, R., G. Magnusson and S. Agnarsson 2000. The Norwegian Spring-Spawning Herring Fishery: A Stylized Game, *Marine Resource Economics* 15: 293-3.

Balton, David A. 2001. The Bering Sea Doughnut Hole Convention: Regional Solution, Global Implications, in Olav Schram Stokke (ed.), *Governing High Seas Fisheries: The Interplay of Global and Regional Regimes*, Oxford, Oxford University Press: 143-178.

Bjorndal, Trond and Daniel Gordon 2000. The Cost of Harvesting Herring, *Marine Resource Economics* 15: 281-292.

_____, _____, M. Lindross and V. Kaitala 2000. International Management Strategy for a Migratory Fish Stock: A Bio-economic Simulation Model of the Norwegian Spring Spawning Herring Fishery. Prepared for the 10th Biennial Conference of the International Institute of Fisheries Economics and Trade, Corvallis.

_____, A.D. Hole, W.M. Slinde, and F. Asche 1998. Norwegian Spring Spawning Herring–Some Biological and Economic Issues. Norwegian School of Economics and Business Administration, Centre For Fisheries Economics, Papers of Fisheries Economics 38.

_____ and G. Munro 2000. The Management of High Seas Fishery Resources and the Implementation of the UN Fish Stocks Agreement of 1995: Problems and Prospects. Prepared for the 10th Biennial Conference of the International Institute of Fisheries Economics and Trade, Corvallis.

Caddy, John F. 1997. Establishing A Consultative Mechanism or Arrangement for Managing Shared Stocks Within the Jurisdiction of Contiguous States, in D. Hancock (ed.), *Taking Stock: Defining and Managing Shared Resources*, Australian Society for Fish Biology and Aquatic Resource Management Association of Australasia Joint Workshop Proceedings, Darwin, NT, 15-16 June 1997, Sydney, Australian Society for Fish Biology: 81-123.

Clark, Colin 1980. Restricted Access to a Common Property Resource, in P. Liu (ed.), *Dynamic Optimization and Mathematical Economics*, New York, Plenum Press: 117-132.

_____1990. *Mathematical Bioeconomics: The Optimal Management of Renewable Resources*, Second Edition, New York, Wiley Interscience.

FAO of the UN 1979. *Interim Report of the ACMRR Working Party on the Scientific Basis of Determining Management Measures*, FAO Fisheries Circular No. 718, Rome

_____ 1992. *Marine Fisheries and the Law of the Sea: A Decade of Change*, FAO Fisheries Circular No. 853, Rome.

_____1994. *World Review of Highly Migratory Species and Straddling Stocks*. FAO Fisheries Technical Paper 337, Rome.

_____1999. The International Plan of Action for the Management of Fishing Capacity, Rome.

_____2001. International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, Rome.

Gordon, H.S. 1954. The Economic Theory of a Common Property Resource: The Fishery. *Journal of Political Economy* 62: 124-142.

Gulland, John A. 1980. *Some Problems of the Management of Shared Stocks*, FAO Fisheries Technical Paper No. 206, Rome.

Kaitala, Veijo 1985. *Game Theory Models of Dynamic Bargaining and Contracting in Fisheries Management*, Helsinki, University of Helsinki, Institute of Mathematics, Systems Research Reports A11.

_____and M. Lindroos 1998. Sharing the Benefits of Cooperation in High Seas Fisheries: A Characteristic Function Game Approach, *Natural Resource Modeling 11*: 275-299.

_____, and G. Munro 1993. The Management of High Seas Fisheries, *Marine Resource Economics* 8: 313-329.

_____, and G. Munro 1997. The Conservation and Management of High Seas Fishery Resources Under the New Law of the Sea, *Natural Resource Modeling* 10: 87-108.

_____,and M. Pohjola. 1988. Optimal Recovery of a Shared Resource Stock. *Natural Resource Modeling* 3:91-119.

Levhari, D. and L.J. Mirman 1980. The Great Fish War: An Example Using a Dynamic Cournot-Nash Solution, Bell Journal of Economics 11: 649-661.

Lindroos, Marko 2002. Coalition in Fisheries. Paper prepared for the XIVth Annual Conference of the European Association of Fisheries Economists, Faro, Portugal.

Luce, R.D. and H. Raiffa, 1967. *Games and Decisions: Introduction and Critical Survey*, New York, John Wiley & Sons.

McRae, D. and G. Munro 1989. Coastal State "'Rights" Within the 200 Mile Exclusive Economic Zone, in P. Neher, R. Arnason and N. Mollet (eds.), *Rights Based Fishing*, Dordrecht, Kluwer: 97-112.

Miller, K., G. Munro, T. McDorman, R. McKelvey and P. Tydemers 2001. The 1999 Pacific Salmon Agreement: A Sustainable Solution?, *Occasional Papers: Canadian-American Public Policy, No. 47*, Orono, Canadian-American Center, University of Maine.

Molenaar, E. 2000. The Concept of "Real Interest" and Other Aspects of Cooperation through Regional Fisheries Management Mechanisms, *The International Journal of Marine and Coastal Law* 15: 475-531.

Munro, Gordon 1979. The Optimal Management of Transboundary Renewable Resources, *Canadian Journal of Economics* XII: 355-3776.

_____982. Cooperative Fisheries Arangements between Pacific Coastal States and Distant Water Fishing Nations, in H.E. English and A.D. Scott (eds.), *Renewable Resources in the Pacific*, Ottawa, International Development Research Centre: 247-253.

_____ 1987. The Management of Shared Fishery Resources Under Extended Jurisdiction, *Marine Resource Economics* 3: 271-296.

_____ 1991. The Management of Migratory Fishery Resources in the Pacific: Tropical Tuna and Pacific Salmon, in R. Arnason and T. Bjorndal (eds.), *Essays on the Economics of Migratory Fish Stocks*, Berlin, Springer-Verlag: 85-106.

_____2000. The UN Fish Stocks Agreement of 1995: History and Problems of Implementation, *Marine Resource Economics* 15:265-280.

_____ and Robert Stokes 1989. The Canada-United States Pacific Salmon Treaty, in D. McRae and G. Munro (eds.), *Canadian Oceans Policy: National Strategies and the New Law of the Sea*, Vancouver, University of British Columbia Press: 17-35.

Nakken, Odd, Per Sandberg and Stein I. Steinsham 1996. Reference Points for Optimal Fish Management: A Lesson to be Learned from the Northeast Arctic Cod Stock, *Marine Policy* 20: 447-462.

Nash, J. 1951. Noncooperative Games. *Annals of Mathematics* 54:289-95.

_____. 1953. Two-Person Cooperative Games. *Econometrica* 21:128-40.

Orebech, P. K. Sigurjonsson and T.L. McDorman 1998. The 1995 United Nations Straddling and Highly Migratory Fish Stocks Agreement: Management, Enforcement and Dispute Settlement, *The International Journal of Marine and Coastal Law* 15: 361-378.

OECD 1997. *Towards Sustainable Fisheries: Economic Aspects of the Management of Living Marine Resources*, Paris.

Owen, Daniel 2001. Legal and Institutional Aspects of Management Arrangements for Shared Stocks with Reference to Small Pelagics in Northwest Africa, study undertaken for the Food and Agriculture Organization of the UN, and the Nansen Programme on Fisheries Management and Marine Environment, GCP/INT/730/NOR.

Pintassilgo, Pedro forthcoming. A Coalition Approach to the Management of High Seas Fisheries in the Presence of Externalities, *Natural Resource Modeling*.

Stokke,Olav Schram 2001. The Loophole of the Barents Sea Fisheries Regime, in Olav Schram Stokke (ed.), *Governing High Seas Fisheries: The Interplay of Global and Regional Regimes*, Oxford, Oxford University Press: 273-302.

The Economist 1994, 333: 96.

Treaty between the Government of Canada and the Government of the United States of America Concerning Pacific Salmon, March 1985.

Tucker, A.W. 1950. A Two-Person Dilemma, Stanford University, unpublished.

United Nations 1982. United Nations Convention on the Law of the Sea. UN Doc. A/Conf. 62/122.

_____1995. United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks. Agreement for the Implementation of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. UN Doc. A/Conf./164/37.

United States of America, Department of State 1999. Diplomatic Note No. 0225 from Canada to the United States; reply attached Agreement, June 30. http://www.state.gov.

LEGAL ASPECTS IN THE MANAGEMENT OF SHARED FISH STOCKS – A REVIEW

by

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INTRODUCTION

The main trust of the 1982 Convention is the division of the ocean space into different jurisdictional areas and the identification of the rights and duties of States within those various areas. However notably the preamble recognizes that "the problems of ocean space are closely interrelated and need to be considered as a whole". It further exhorts States to cooperate or to negotiate in order to address trans-boundary ("transjurisdictional") problems, such as the management of shared stocks and the conservation of straddling fish stocks.

The present paper takes as a starting point the regime set out in the Law of the Sea Convention 1982 (1982 Convention) respectively with regard to the shared stocks and the straddling stocks. The Convention has entered into force in 1994. It focuses then on the recent international developments which allow for a better implementation of the high seas fisheries regime. In the present debate there are a lot of jurisdictional questions at heart of the matters dealt with but a fundamental issue with regard to shared and straddling fish stocks concerns the development of appropriate management and conservation regimes. The 1982 Convention and the 1995 UN Fish Stocks Agreement[1] provide the basic framework for such regimes. The Convention lays also the basis for States to negotiate or cooperate. Such negotiation and cooperation may be effected through bilateral or other agreements or may take place through appropriate sub-regional and regional organizations. The present Expert Consultation is to focus on stocks which migrate between the EEZs of two or more States (usually known as "shared or joint stocks") and/or between the EEZ (s) and the waters beyond ("straddling stocks").

Before entering into the basic legal regime governing these stocks and the legal issues, it is worth to clarify a few points of terminology. In the title of this Consultation the term "shared" stocks is used in a broad and generic manner to connote thus stocks which are, or could be, exploited by fishing fleets from two or more States including the 1982 UN Convention Article 63(1) stocks occurring within the EEZ of two or more coastal States, Article 63(2) stocks occurring both within the EEZ and in the area beyond and adjacent to it (so called "straddling" fish stocks). Article 64 highly migratory stocks as well as other stocks occurring in the high seas that have more recently been qualified as "discrete stocks".

Among fisheries lawyers, "shared stocks" are most often exclusively those reflected in Article 63, (1) of the 1982 Convention whereas the term "transboundary stocks" encompasses all fish stocks which cross a boundary whichever it is.[2] The latter term thus includes shared stocks (1982 UN Convention, article 63(1)), straddling stocks (Ibid., Article 63 (2))[3] and highly migratory species (Ibid. Article 64). Notably however, nor the latter Convention, nor the 1995 UN Fish Stocks Agreement have any explicit reference to the term "shared fish stock". Perhaps even more surprisingly, in the FAO Code of Conduct for Responsible Fisheries

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[1] Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

[2] The term "transboundary stocks" intends to denote that the geographical area in which these stocks occur are nit confined to the maritime zones o f a single State, a RFOs regulatory area or high seas. (see E. Hey, The Regime for the Exploitation of Transboundary Marine Fisheries Resources (Dordrecht, Martinus Nijhoff Publishers,1989,p.1) The Code of Conduct for Responsible Fisheries in section 7.1.3 use "transboundary stocks" to denote shared stocks.

[3] See also article 3 (1) of the 1995 UN Fish Stock Agreement.

the term "transboundary stocks", particularly in its sections 7.1.3 and 7.3.2., seems to denote what has sofar among fisheries lawyers and other academicians been termed as "shared" stocks (i.e. Article 63 (1) stocks). The term is further used in provisions concerning transboundary aquatic ecosystems (sections 6.4, 9.2, 10.4) and in a very broad manner in section 12.17. One should bear in mind that the FAO Code of Conduct covers much more than marine (capture) fisheries: the broadness reflects the reality of a fisheries sector, which may encompass, inland and marine fisheries, aspects of coastal zone management, capture fisheries and aquaculture.[1] Thus, the Code, by applying to all fisheries, covers fisheries on the high seas, within the EEZ, in territorial waters, as well as in inland waters (lakes, rivers, etc.), even when they are in shared waters. For this simple reason and with the view to find a globally acceptable terminology, the use of the term "transboundary" may have been preferred by the countries' representatives, the authors of the Code. Of further significance is the manner in which the term "transboundary" was translated into French and Spanish, namely *stocks transfrontières* and *peces transfronterizas*. In the latter languages, the term alludes to the fact that fish stocks cross "boundaries", "frontières", "fronterizas", whether maritime boundaries or freshwater boundaries. Maritime boundaries may be those dividing an EEZ from the high seas, those between two EEZs or those between two territorial seas. An equivalent array of boundaries does not exist in freshwater areas, like lakes, basins, rivers, etc..[2] The term may also hint at the fact that such stocks because they are *transboundary*, they may be of international concern and thus call for cooperation. Finally the term "transboundary" fish stocks may have been preferred to "shared" fish stocks to avoid any attempt to encompass an implicit reference to notions of prior appropriations or vested rights or other, whether in relation to fish stocks in international rivers or marine waters. Finally, it would seem that the term straddling (in English) or "chevauchants" (in French) have no equivalent wording in Spanish. Indeed the Spanish version of both the Code and the UN Fish Stocks Agreement uses the word "poblaciones de peces transzonales".

The present paper draws on the terms "shared stocks" and "straddling fish stocks" from a legal perspective and embraces thus the fisheries lawyers' concepts.

Shared Stocks

The legal regime

The 1982 Convention contains one brief provision relating to shared stocks namely Article 63 (1).

"Where the same stock or stocks associated species occur within the exclusive economic zones of two or more coastal States, these States shall seek, either directly or through appropriate subregional or regional organizations, to agree upon the measures necessary to coordinate and ensure the conservation and development of such stocks without prejudice to the other provisions of this Part"(Article 63(1))

The Convention imposes a duty to negotiate arrangements for the management of shared stocks but there is not duty to reach an agreement. If no agreement is reached, each State shall manage that part of the shared stock occurring within its EEZ in accordance with the rights and duties relating to fisheries management and conservation by a coastal State in its EEZ. The Convention does not further elaborate on the management and conservation objectives or on the allocation of catch among the relevant States for the purposes of effective management of shared resources. Burke states colourfully that "[t]he substantive obligation imposed by Article 63(1) cannot fairly be described as awesome, imposing, or, even, perhaps, very consequential".

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[1] The Code of Conduct for Responsible Fisheries has the widest scope. It is stated to be "*global in scope, and is directed towards members and non-members of FAO, fishing entities, subregional, regional and global organizations, whether governmental or nongovernmental, and all persons concerned with the conservation of the fishery resources and management and development of fisheries, such as fishers, those engaged in processing and marketing of fishery products and other users of the aquatic environment in relation to fisheries.*" It continues: "*It also covers the capture, processing, trade and marketing of fish and fishery products, fishing operations, aquaculture, fisheries research and the integration of fisheries into coastal area management.*"

[2] Many writers class as "international" all rivers which separate or traverse different States and thus are of international concern.

In the *North Seas Continental Shelf* cases[1] the International Court of Justice dealt with the duty to negotiate in the context of maritime boundary limitations: "*the parties are under the obligation to enter into negotiations with a view to arriving at agreement, and not merely to go through a formal process of negotiation ... they are under the obligation so to conduct themselves that the negotiations are meaningful, which will not be the case when either of them insists upon its own position without contemplating any modification of it.*"[2]

These observations on the substantive standards that negotiations must meet are in fact applications of the principle of good faith to specific circumstances.[3]

Regarding the term "development", Nandan *et al.*[4]. state that:

The reference to "development" ... relates to the development of those stocks as fishery resources. This includes increased exploitation of little-used stocks, as well as improvements in the management of heavily-fished stocks for more effective exploitation. Combined with the requirement in article 61 of not endangering a given stock by overexploitation, this envisages a long-term strategy of maintaining the stock as a viable resource.

The provisions of the 1982 Convention on marine scientific research are potentially applicable to the management of shared stocks (see *inter alia* Arts 246(3), 246(5)(a) and 249 LOSC). There are other provisions of the Convention that are relevant to a consideration of shared fish stocks. These include the provisions relating to the settlement of disputes (Part XV), article 300 concerning "Good faith and abuse of rights" and the articles relating to coastal State rights. The Code of Conduct, though not a binding instrument, is also relevant through both its provisions on fish stocks generally and those more specifically aimed at shared stocks (see paragraphs 7.1.3, 7.3.2 and 12.17).

In practice

In practice States have been able to agree on cooperative arrangements for the management of shared stocks to a considerable extent. Some arrangements have been operated successfully for a decade or more.

A variety of cooperative arrangements have been put in place upon the initiative of particular States or group of States. The organisational diversity (forms, objectives, institutional structure) offer a important range of variety. These arrangements exist to facilitate cooperation related to a variety of issues related to shared stocks, such as information gathering and exchange, scientific research, maritime boundaries, mutual access, resource management and conservation and control and surveillance. The evolution of the Law of the Sea is likely to have influenced at times the organisational diversity.

Arrangements often provide for various institutional structures (primary consultative mechanism, meeting frequency, size and/or composition of delegations). Sometimes a commission or equivalent body is provide for bearing different mandates in the fields of stock and research assessment, conservation and management, and monitoring control and surveillance (MCS). In most cases the mandate of the commissions or equivalent body is highly specific to each arrangement.
From a point of view of form and institutions, Churchill and Lowe identify four main categories :

A. a group of agreements taking the form of a periodic (usually annual) arrangement negotiated under a pre-existing framework treaty;
B. a group of arrangements where a bilateral commission set up for the specific purposes of management of the shared stocks;
C. regional fisheries organisations

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[1] I.C.J. Reports 1969, p.3
[2] Ibid., page 47.
[3] Erik Jaap Molenaar, *The Concept Of "Real Interest" And Other Aspects Of Cooperation Through Regional Fisheries Management Mechonisms, IJMCL, Vol 15,Na.14*
[4] Nandan, S.N., S.Rosenne and N.R.Grandy (eds), *United Nations Convention on the Law of the Sea 1982: A Commentary*, vol II (Dordrecht: Nijhoff, 1993)

D. general cooperation agreements for the management of shared stocks on an *Ad Hoc* basis but the likelihood that management measures have been adopted is uncertain.

Group A

This group includes the series of annual arrangements agreed between Norway and the EU within the framework of the Fisheries Agreement of 27 February 1980, whereby both countries yearly conduct consultations on management measures and allocation of mutual fishing rights for the coming year. The consultations are based on the recommendations from the International Council for the Exploration of the Sea (ICES). Total allowable catches (TAC) are fixed for the shared stocks valid for both the Norwegian EEZ in the North Sea and EU-waters in the North Sea. The TACs are then allocated between both parties on the basis of the zonal attachment. This process leads to yearly Agreed Records of the consultations to be implemented the coming year. Provisions on a balanced exchange of fishing possibilities can be found in this reciprocal agreement; the economic value of quotas allocated to Norway in for instance EU waters should be equal to the value of the quotas allocated to the EU in Norwegian waters.[1] Both parties have also developed a closer and closer cooperation in the field of monitoring control and surveillance and in addition to a cooperative arrangement with the EU, Norway has entered into Control Arrangements with relevant members States of the EU. In this respect the exchange of inspectors/observers on Coast Guard vessels and at landing sites are of particular importance. More recently Norway and EU introduced a satellite based VMS system and have entered into a specific arrangement on VMS to harmonize initiatives and regulations.

Another example is the 1989 Agreement between Denmark, Iceland and Norway concerning the Capelin Stocks in the Waters between Greenland, Iceland and Jan Mayen, under which yearly consultations and negotiations are held to decide on unilateral/bilateral quota arrangements, licensing arrangements and other management measures.

This Group could also include the 1978 Treaty between Australia and Papa New Guinea on Sovereignty and Maritime Boundaries where the Parties adopt management measures for the fisheries of the Protected Zone in the Torres Strait, including the setting of TACs allocated between the Parties in fixed percentages (depending on the area concerned).

Examples under this group include the bilateral fisheries agreement between Norway and Russia. Within the framework of the Fisheries Agreements of 1975 and 1976, yearly quota consultations are performed by the Joint Norwegian-Russian Fisheries Commission established by the Agreement of 1975. The Commission consultations are scientifically based upon recommendations from ICES. The primary task of the Commission is to agree on the TACs for the shared stocks. The TACs are to cover the whole migration area of the stocks. Unlike the consultations between Norway and the EU, the Joint Norwegian-Russian Fisheries Commission not only consults on the quota allocation between the Parties, but also on quota allocations to third States. Rules on how fish caught by licensed third States vessels are to be deducted from the Parties' allocation are laid down in the arrangement. The cooperation between the two countries has led to two major achievements: the establishment of a so-called Surveillance Programme in the Barents Sea and the implementation of measures to improve the selectivity of fishing gear. The Programme introduced in the late 80s allows for fishing grounds to be continuously surveyed with a view to closing areas where fish below a prescribed minimum size is abundant. The Programme is considered as being an arrangement for closing and opening of fishing grounds on a real-time basis. For the purposes of improving the selectivity of fishing gear, the Parties have centred on the development on grid-sorting systems in the trawl fishery.[2] The creation in 1993 of the Permanent Committee on Management and Control of the Fisheries Sector has provided a basis for cooperation in the field of MCS. Control both at sea and on land have been improved, procedures have been put in place between the Parties Coast-Guards and Control-Authorities, including the exchange of information on catch-and landing data, exchange of inspectors/observers on board of Coast-Guard vessels and in ports have occurred. A satellite-based VMS in Parties' economic zones has also been established. In 2000 the basis for the cooperation on MCS was further formalized between the Parties, when an

[1] Arne Wage, *Norway's Experience: management of common stocks focusing on issues related to the "Grey Zone"*, Seminar on International Marine Fisheries and Introduction of Vietnam's draft Fisheries Law, Sept. 2001.
[2] Ibid., p.6.

Arrangement on MCS was entered into. On the Norwegian side, the Directorate of Fisheries and the Coast-Guards have signed the Arrangement.[1]

The International Pacific Halibut Commission, set up by the 1953 Convention on the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea as amended by a Protocol of 1979 is another representative example of this group. The Convention applies to the waters under the "exclusive fisheries jurisdiction" of each party, collectively known as "Convention waters". The Commission deals with commercial and sport fishery for Pacific halibut (*Hippoglossus stenolepis*). Interestingly it has a power to hold annual meetings with representatives of the halibut fishery industry. It may alternate its regular annual meeting and its mid-year meeting between Canada and the United States, and may hold other meetings as it may determine necessary. It may also hold public hearings as may be determined by the Commission. It establishes allocation percentages for halibut stocks shared by Canada and the USA in the North Pacific and Bering Sea. Other management measures adopted include closed seasons, minimum fish size and gear regulations. The Commissioners consider reports from three groups in total (i.e. the Board, the P Processor Advisory Group and the Commission staff) when making final decisions. Article III(1) of the Convention states that "[a]ll decisions of the Commission shall be made by a concurring vote of at least two of the Commissioners of each Party". They are advisory in nature and conservation and management measures decided by the Commission require the approval of the parties (Art III(3)). The trigger for decision of measures is that "investigation has indicated such action to be necessary". The measures may be decided with respect to (a) national and fishing vessels of the parties and (b) fishing vessels licensed by the parties.

Group C

Regional fisheries organisations do also deal with shared stock. This can be illustrated by the Baltic Sea Fisheries Commission, established by the 1973 Convention on Fishing and Conservation of the Living Resources of the Baltic Sea and Belts. Contracting parties to Convention as amended by Protocol: Estonia, European Community, Latvia, Lithuania, Poland, Russia (having succeeded the USSR as a party). The Convention applies to" all fish species and other living marine resources in the Convention Area". The Convention Area includes all waters of the Baltic Sea and the Belts excluding internal waters. The Commission, based in Warsaw, under Art IX(1), is to: (a) coordinate resource management "by collecting, aggregating, analysing and disseminating statistical data"; (b) promote coordination, "as appropriate", of scientific research; (c) prepare and submit recommendations "concerning measures referred to in Article X" (see below) for consideration by the parties; and (d) to examine certain information submitted by the parties.

Except where the Commission decides otherwise, its sessions are to be held every two years. In practice, the Commission meets annually (Rules of Procedure for the Commission, rule 6.1). "To perform its functions the Commission may set up working groups or other subsidiary bodies and determine their composition and terms of reference". Examples of bodies established include the following: Standing Working Group on Regulatory Measures; Standing Working Group on Finance and Administration; Working Group on Control and Enforcement; IBSFC Salmon Action Plan Surveillance Group; Working Group on Long Term Management Objectives and Strategies for Herring and Sprat; Working Group on Fishery Rules. Each party is to have one vote. Decisions and recommendations of the Commission are to be adopted by a two-thirds majority of votes of the Contracting States, present and voting at the meeting. However, any recommendation relating to a party's waters shall only enter into force for that party only if that party votes for it (Art VIII(3)). The Convention, under Article XI establishes an objection procedure. Thus though recommendations are binding on the parties, a recommendation will not become binding on a party that had objected to it. A party may at any point withdraw its objection. There is also under Article XI a termination procedure: from after the date of entry into force of a recommendation a party may notify its termination of acceptance, where upon the recommendation will cease to be binding on that party one year later.

In practice, the Commission has established a consolidated set of Fishery Rules. This is updated after each Commission meeting. They include rules on *inter alia*: inter-annual TAC flexibility; quota exchange (e.g. herring against cod) and quota transfers (e.g. cod); catch reporting; refusal of landings; logbooks; prohibitions on certain types of fishery (end use of fish; method; species); prohibitions on certain species or sizes of fish on board; gear stowage; permissible by-catch; discarding; gear characteristics; marking of

[1] Ibid., p.8

fishing gear; and closed areas and seasons. The TACs themselves are listed separately from the Fishery Rules. The TACs are established each year at the Commission meeting for the following year, for the main four commercially exploited species, i.e. cod, herring, salmon, and sprat. The Commission website reports that "TACs have been the main tool or basic tool of the management procedure and they have been introduced first in 1977 for cod, sprat and herring, and in 1988 for salmon".

Long-term management schemes have been adopted. The Commission website states that these include: (a) the 1997 Salmon Action Plan; (b) the 1999 Long Term Management Strategy for Cod Stocks in the Baltic Sea; and (c) the 2000 Long Term Management Strategy for the Sprat Stock; a Long Term Strategy for the Herring Stock will be further discussed in 2001.

Finally illegal fishing and underreporting have been important issues a few years ago and led the Commission to adopt control measures such as port/landing controls, a yearly established record of licensed fishing vessels in the Baltic Sea on country basis and more recently a Joint Inspection/Observers Scheme

Group D

There is a group of agreements where the parties undertake in a general way to cooperate over the management of shared fish stocks on an *ad hoc* basis. A typical example is the Convention on the Fisheries Cooperation among the States bordering the Atlantic Ocean adopted in 1991. There are 10 contracting parties and the objectives of the Convention include *inter alia* to promote regional cooperation on fisheries management and to enhance, coordinate and harmonize the parties' efforts and capabilities for the purpose of conserving and exploiting fishery resources, considering in particular fish stocks occurring within the waters of more than one party. The geographical area covered is assumed to be waters under the sovereignty and jurisdiction of the contracting parties. Parties are to adopt protocols addressing measures, procedures and standards aimed at implementing the provisions of the Convention.

Another example of this group is the Nauru Agreement concerning Cooperation in the Management of Fisheries of Common Interests of 1982. The scope of the agreement is to coordinate and harmonize, and to cooperate on, monitoring, control and surveillance of fisheries (notably those carried out by foreign fishing vessels) for common stocks in waters under the fisheries jurisdiction of the parties. An annual meeting of the Parties is to be convened preceding or following the regular session of the Forum Fisheries Committee in order to promote the implementation of this Agreement. The parties are to seek the assistance of the Forum Fisheries Agency in providing secretariat services for implementing and coordinating the provisions of the Agreement, for instance in establishing procedures and administrative arrangements for the exchange and analysis of *inter alia* catch and effort statistics regarding vessels fishing in the parties' waters for common stocks; for the exchange and analysis of *inter alia* information on vessel specifications and fleet composition. The parties are to seek to standardize their respective licensing procedures and in particular: (a) to seek to establish and adopt uniform measures, terms and conditions, and procedures relating to the licensing of foreign fishing vessels, including application formats, licensing formats and other relevant documents; and (b) to explore the possibility of establishing a centralized licensing system of foreign fishing vessels.

To conclude, each institutional structure is likely to differ according to the particular needs of the fishery concerned. In many instance the functions are exercised with an overall objective to ensure coordination among the approaches of their member States within their EEZ. Undoubtedly where effective management powers are in place and real sharing of stocks occur, the issue of sharing is the fundamental issue and can be a prerequisite for the establishment of the agreement itself.

However it seems that they must have some features in place to be effective :

- Access to scientific information, a mechanism for assessing such information and for determining the state of the stocks concerned;
- A Procedure for defining the appropriate conservation and management measures for the stocks concerned, including the TAC
- A Procedure for determining effort limitations or for allocating quotas to States fishing those stocks;
- Some mechanism for enforcement and MCS;
- Some procedure for dispute settlement.

Straddling Fish Stocks

Two international instruments are primarily relevant for discussing the legal regime concerning straddling fish stocks. They are the 1982 Convention and the 1995 UN Fish Stocks Agreement.

The 1982 Convention

The extent to which the issue of straddling stocks would become contentious appears not to have been anticipated during the negotiations of the 1982 Convention. Under the current structure of the 1982 Convention the provisions relevant for the purposes of straddling stocks are contained in Part V relating to the EEZ and in Part VII relating to the high seas. It evidences a critical problem to resolve : how to reconcile the rights of States to fish on the high seas with the rights of the coastal States to manage the resources within their 200-miles EEZ. The problem has arisen specifically with straddling stocks. Straddling fish stocks open the question of responsibility for high seas management and, of the relationship between high seas management and the management by coastal states of straddling stocks within their exclusive economic zones. In practice it opens a debate with regard to the management of such stocks : coastal States see a risk for example that any management measures taken in its EEZ is like to be undermined by activities of vessels fishing on the high seas. Vice-versa distant-water fishing nations fear to see coastal States, which have gained control over the resources within their EEZ, wishing to extend their jurisdiction beyond 200 miles of the coast to the resources that are harvested on the high seas.

Articles 63 (2) and 116 of the 1982 Convention provide an essential starting point for the resolution of problems that have arisen in the implementation of the straddling stocks regime.

Article 63 (2) provides as follows:

Where the same stock or stocks of associated species occur both within the exclusive economic zone and in an area beyond and adjacent to the zone, the coastal State and the States fishing for such stocks in the adjacent area shall seek, either directly or through appropriate sub-regional or regional organizations, to agree upon the measures necessary for the conservation of these stocks in the adjacent area.

Yet again this provision does not offer that much guidance as to how the problems involved in regulating straddling stocks are to be addressed. Notably cooperation is called for in particular and only to take measures for conservation purposes in respect of the high seas (*for the conservation of these stocks in the adjacent area)*, not in respect of the EEZ. The duty to cooperate under international law has a substantive content which may be expressed in terms of a general obligation to cooperate i.e. duties to notify, to consult and to negotiate.[1] It is also generally accepted under international law that the duty to cooperate does not involve the duty to reach in an agreement provided that the cooperation has been undertaken in good faith.

Under Article 116(2) it is clear that the high seas right to fish is subject to the "*rights and duties as well as the interests of coastal States provided for, inter alia, in article 63 paragraph 2*". In respect of straddling stocks, the question is what are the "rights, duties and interests" of the coastal State while the stocks are on the high seas? The interest of the coastal state arises at the time that conservation measures including the allowable catch is determined. The coastal State, whether or not it is interested in the exploitation of the straddling fish stock on the high seas, has always an interest in the long term viability of the stock. The coastal state is responsible for the conservation and the management of the fish stocks within its EEZ and its nationals may have an interest in exploiting the stock. By contrast the high seas fishing State may or may not have an interest in the exploitation of the straddling stock and if it is interested it will be primarily in the exploitation of the stock.

The 1982 Convention does not give the opportunity to the coastal state, or any other state to prevent all high seas fishing of straddling stocks by withholding agreement from all proposals for the conservation and management of those stocks. It is further quite clear that the 1982 Convention does not provide any basis for a coastal State to make any preferential claim to a share in the catch of that stock taken on the high seas.

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[1] P. Reuter, "De l'obligation de négocier", Studi in onore di Gaetano Morelli, Communicazioni e studi,vol. XIV (Milan, Giiuffre, 1975), p. 711-733

The effective implementation of the legal regime provided for under the 1982 Convention depends on States acting in accordance with article 63 (2) and section 2 of Part VII and on the use of the dispute-settlement mechanism contained in the Convention and, where necessary, on further development of that mechanism.

Challenging issues for sub-regional and regional organizations or arrangements

Examples of these competing individual interests can be found in different areas of the world where straddling stocks occur. In the North West Atlantic the problem has focused around the cod stocks. Securing agreement of all its members on quotas has been (and is) a real challenge. Disputes arose within the North West Atlantic Fisheries Organization[1] which has jurisdiction to set quotas for those stocks as far as they are found beyond the Canadian 200 miles fishing zone. The setting of a formula by which the TAC is to be determined has been part of the dispute over straddling stocks. The NAFO Convention provides that its Fisheries Commission should "*seek to ensure consistency*" between the proposals for the management of straddling stocks in its regulatory area beyond 200 miles and measures taken by the coastal State in respect of that stock within 200 miles"[2] Under the terms of the NAFO Convention, States that have objected to "proposals" are not bound by them when they become binding on other member States, and those bound may withdraw on giving one year's notice.[3] A further problem is created by those who are not members of NAFO and who thus fish on the "nose" and the "tail" of the Grand Banks of Newfoundland in an unregulated way. In order to secure compliance with its measures, NAFO adopted a scheme of joint international inspection and surveillance in 1995.

A second significant area is the so-called "Donut Hole" with the problem of straddling Pollock stocks. The "Donut Hole" is an enclave of high seas in the Bering Sea, surrounded by the EEZs of the United States and Russia. Discussion started in 1991 between the coastal states and the distant water fishing nations to face problems of over-fishing and illegal incursions in the EEZs of relevant coastal states. In 1992 the former Soviet Union and the USA called for a moratorium on fishing in the Donut Hole in the light of the serious decline of the Pollock resources in the area. The matter was complex because the USA and Russia although coastal states with respect to the Donut Hole area and have themselves fished there, are also distant water fishing nations in other areas in which there are straddling stocks. In 1994 the two coastal states together with the 4 relevant distant water fishing nations (*China, Korea, Japan and Poland)* signed the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea. The aim of the Convention is to establish an international regime for the conservation, management and optimum utilisation of the Pollock resources of the Donut Hole which will restore and maintain Pollock resources at a level that permit maximum sustainable yield. This is undertaken by the Annual Conferences of the parties, advised by a Scientific and Technical Committee, setting the allowable harvest level, which is then to be divided by individual quotas and adopting such other management and conservation measures as deemed appropriate. Where agreement cannot be reached among the members during the Annual Conference on the allowable harvest level, the Convention contains several fall back measures. Notably, unlike other regional fisheries organisations or arrangements, the Convention does not allow parties to opt out of measures with which they do not agree. The Convention provides also for a control and inspection scheme to ensure compliance with the adopted measures. In order to deal with the non-parties and "free rider" problems, the Convention provides that its parties shall encourage non-parties to respect the Convention's provisions. In addition parties are to develop efforts to prevent their fishing vessels from transferring their registration in order to avoid compliance with the Convention.

As the case studies are likely to show, other similar straddling-stocks problems exist, for example concerning the orange roughy stock located off the west coast of the South Island of New Zealand. And in another part of the world, Norway, EU, Iceland and the Faeroe Islands, and Russia are currently negotiating over a coastal State management regime for the blue-whiting stocks. Numerous meetings over the past couple of years took place but no agreement has been reached so far. The main issue remains the sharing of the stock.

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[1] Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries, Ottawa, 24 October 1978. Website: http://www.nafo.ca/

[2] Article XI.

[3] Ibid., article XII

The practice of cooperation under existing regional or sub-regional organisations or arrangements (RFOs)[1] is likely to face a series of challenging issues which are listed below. First and foremost it can hardly be expected to be any particular management that will provide all of the answers to straddling fish stocks management. However key to a successful cooperative system seems to be the acquisition of adequate scientific information and the definition of an appropriate management principle. Adequate scientific information allows for the principle to be determined on which quotas will be based. Some organisations have been able to develop their own scientific advice, others not. Allocation of quotas poses particular problems and linked to this emerges the problem of new entrants. New entrants, under the 1982 Convention, would be entitled to be allocated a quota under the high seas fishery regime. Article 116 entitles nationals to engage in high seas fishing and those who cooperate in conservation and management measures in accordance with article 119 should not in principle be excluded from a share in TAC. But the questions are: what happens if the fishery is fully exploited? How are the shares to be determined? And quid if a States has undertaken several enhancement activities and wishers to claim it is entitled to the benefits of its enhancement activities?[2] In other words: how to balance the interests? Other challenges include monitoring and enforcement which with respect to high seas fishing vessels rest primarily with the responsibility of the flag State. And how to deal with free-riders. It goes further without saying that these challenges, and probably many others have institutional implications.

Definitely, the problems of straddling stocks concern the interests of both the coastal States and the high seas fishing nations. The former has interest in the conservation and management of the resources occurring within their 200-mile zones and the latter have interests in the exploitation (and therefore most likely the conservation and management) of the living resources of the high seas. Cooperation and collaboration can only resolve these matters and this is what Article 63 (2) of the 1982 Convention calls for. It requires coastal States and States fishing for such stocks in adjacent areas to seek "*either directly or through appropriate subregional or regional organizations, to agree upon the measures necessary for the conservation of these stocks in the adjacent areas*".

The 1995 UN Fish Stocks Agreement

Basic elements

The United Nations Conference on Environment and Development, 1992, adopted Agenda 21, paragraph 17.49 which prompted the development of a series of international fisheries instruments, one of which is the 1995 UN Fish Stocks Agreement. (sometimes referred to also below as "the 1995 Agreement").

Two important elements emerge among these international initiatives: the reinforcement of flag State responsibilities and the promotion of cooperation, especially at sub-regional and regional level.

The 1995 UN Fish Stocks Agreement *implements* the 1982 Convention and has provided for more detailed provisions concerning straddling fish stocks and highly migratory fish stocks. The overarching objective is "*to ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks through effective implementation of the relevant provisions of the Convention.*"[3]

The Agreement creates a detailed framework for the management of these stocks. It does also go further and places the conservation and management within a wider context of the need to avoid adverse impacts on the

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[1] The term RFOs will be used as a general term covering arrangements and organisations. FAO happens to use the term «regional fishery bodies» (RFBs), defined as "a mechanism through which three or more States or international organisations that are parties to an international fishery agreement or arrangement collaboratively engage each other in multilateral management of fishery affairs related to transboundary, straddling, highly or high seas migratory stocks, through the collection and provision of scientific information and data, serving as technical and policy forum, or taking decisions pertaining to the development and conservation, management and responsible utilisation of the resources" (FAO Doc. FI:RFB/99/2, Rome, FAO,1999, n.1)

[2] See in this regard the Pacific Salmon Treaty, 1985 involving USA and Canada.

[3] 1995 UN Fish Stocks Agreement, Article 2

marine environment, of the preservation of marine biodiversity, and of the integrity of the marine ecosystem.[1]

The 1995 UN Fish Stocks Agreement applies "*unless otherwise provided*" to the conservation and management of straddling fish stocks and highly migratory species "*beyond areas under national jurisdiction*".[2]

The main elements of the 1995 UN Fish Stocks Agreement

1. the agreement requires coastal states and distant water fishing states (DWFS) to ensure that the conservation and management measures, which are created within the EEZ and on the high seas are compatible.
2. it sets out general principles for the conservation and management of straddling fish stocks and highly migratory fish stocks, including the precautionary approach, which parties to the agreement are to apply on the high seas as well as within the EEZ.
3. the agreement specifies the duties of the flag States with respect to their vessels fishing on the high seas.
4. the agreement includes detailed rules on the establishment and operation of sub regional or regional fisheries management organisations or arrangements ("RFOs[3]") which are to establish conservation and management measures on the high seas. Parties to the agreement are obliged to join RFOs or agree to comply with the measures they create. Otherwise they will not be allowed to fish in the areas where these management and conservation measures apply.
5. the agreement introduces innovative provisions on enforcement for non-flag states, as well as providing for port-state jurisdiction in respect of fishing vessels.
6. the agreement contains detailed provisions on peaceful dispute settlement.

The paper does not elaborate more on the details of these basic elements but highlights a few issues and points which are of particular interest.

Few issues of particular interest

The duty to cooperate

The duty to cooperate is an essential ingredient throughout the 1995 Agreement and a range of obligations to cooperate apply to straddling fish stocks and highly migratory fish stocks. Cooperation in an initial phase is likely to start with series of negotiations and therefore the considerations referred above are relevant also in the present context.[4] The 1995 Agreement offers elements for specifying the duty to cooperate in Article 7 (3) where it provides that "*In giving effect to their duty to cooperate, States shall make every effort to agree on compatible conservation and management measures within a reasonable period of time.*" Furthermore Article 8(2) focuses on the need for States to engage in consultations in "*good faith and without delay*" where a threat of over-exploitation exists or where a new fishery is being developed. The 1995 Agreement is largely supporting regional and subregional cooperation through RFOs. It could be regarded as a set of globally agreed principles under which RFOs should be established and operate.[5] Part III on "Mechanisms For International Cooperation Concerning Straddling Fish Stocks And Highly Migratory Fish Stocks" reflects this assessment.

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[1] W.R.Edeson "*The Law of the Sea: Recent Developments*" Seminar on International Marine Fisheries and Introduction of Vietnam's draft Fisheries Law, Sept. 2001.

[2] Ibid., Article 3.

[3] See Footnote 15. The 1995 Agreement defines an arrangement as " a cooperative mechanism established in accordance with the Convention and this Agreement by two or more States for the purpose, inter alia, of establishing conservation and management measures in a subregion or region for one or more straddling fish stocks or highly migratory fish stocks." In Article 1(1)d.

[4] See the *North Sea Continental Shelf cases in the context of maritime delimitation* referred to on page XXX.

[5] Orrego Vicuña, *The Changing International Law of High Seas Fisheries*, (Cambridge, Cambridge University Press, 1999), pp. 180-183).

The issue of compatibility of conservation and management measures

Article 7 tries to provide a balance between the interests of coastal states and DWFS and "*reduce or eliminate conflicts that may arise between measures taken within an EEZ and those which apply in the adjacent high seas area through a strategy based on cooperation*". Article 7 (1) targets in particular straddling fish stocks and calls on relevant coastal states and states whose nationals fish for such stocks in the adjacent high seas, to "*seek, either directly or through the appropriate mechanisms for cooperation provided for in Part III, to agree upon the measures necessary for the conservation of these stocks in the adjacent high seas area*". These reflects article 63 (2) and restates the distinction between these stocks and highly migratory stocks that is found in articles 63 (2) and 64 of the 1982 UN Convention.

Article 7(2) states the basic obligation to achieve compatibility between the conservation and management measures established for the high seas and those adopted for areas under national jurisdiction "*in order to ensure conservation and management of the straddling fish stocks and highly migratory fish stocks in their entirety.*" To this end, coastal States and States fishing on the high seas have a duty to cooperate for the purpose of achieving compatible measures in respect of such stocks and take into account a variety of factors detailed in article 7(2)(a)-(e) and ensure that such measures do not result in any "*harmful impact on the living marine resources as a whole*".[1] The factors that states are to take into account include the extent to which stocks are found and fished for in areas under national jurisdiction, the biological unity and characteristics of fish stocks, and "*the respective dependence of the coastal States and the States fishing on the high seas on the stocks concerned*".

According to article 7(3), "*States shall make every effort to agree on compatible conservation and management measures within a reasonable period of time*". If no agreement can be reached within a reasonable period of time, article 7(4) allows any of the States concerned to invoke the procedures for the settlement of disputes provided for in Part VIII.

Pending agreement on compatible conservation and management measures, the States concerned have the duty "*to make every effort to enter into provisional arrangements of a practical nature*". In the event that they are unable to agree on such arrangements, any of the States concerned may, for the purpose of obtaining provisional measures, invoke additional procedures for the settlement of disputes provided for in the Agreement.

Mechanisms for international cooperation concerning RFOs (Part III): participation in RFOs

Part III starts with the central Article 8 on "*Cooperation for Conservation and Management*". While the first paragraph allows States to choose the level at which to cooperate, the rest of the Article seems to express a preference for RFOs. Furthermore articles 9 through 13 are all concerned with RFOs. Linked to the geographical scope of an RFO, is the question of participation: which States or other actors have rights or duties to participate in an RFO? At a first glance the type of stocks and geographical range may appear to have some bearings on these rights and duties. However in case of straddling stocks, because of the (qualified) freedom of fishing on the high seas, which all States are entitled to exercise, the issue becomes more complex.[2] Furthermore as article 8(3) of the 1995 reads the duty to cooperate does not automatically translate into a duty to participate in an already existing RFOs or to establish one.[3]Rather "*States fishing for the stocks on the high seas and relevant coastal States shall give effect to their duty to cooperate by becoming members of such organization or participants in such arrangement, or by agreeing to apply the conservation and management measures established by such organization or arrangement.*" As an alternative to becoming member (alias to participate) States (coastal states and those fishing for such stocks) can also apply the RFOs' conservation and management measures.

A major critical issue concerning article 8 is the notion of "real interest" as it is used in paragraph 3 which reads as follows:

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[1] Ibid., Article 7(2)f

[2] Articles 87(1) e and 116 of the 1982 Convention.

[3] Erik Jaap Molenaar, *The Concept Of "Real Interest" And Other Aspects Of Cooperation Through Regional Fisheries Management Mechanisms*, IJMCL, Vol 15,No.14

"States having a real interest in the fisheries concerned may become members of such organization or participants in such arrangement. The terms of participation in such organization or arrangement shall not preclude such States from membership or participation; nor shall they be applied in a manner which discriminates against any State or group of States having a real interest in the fisheries concerned."

The phrase is in all probability too vague to provide a ready answer as to which States will meet this test, and in borderline situations it can be expected to give rise to controversy, as has already happened in the course of the negotiations leading up to the setting up of the case of the Western and Central Pacific Fisheries Organization.

Indeed, the privileged position given to those states in paragraph 4 namely that

"Only those States which are members of such an organization or participants in such an arrangement, or which agree to apply the conservation and management measures established by such organization or arrangement, shall have access to the fishery resources to which those measures apply." will very probably lead to arguments based on the principle of Pacta Tertiis that this provision can only apply to those States which have become Parties to the 1995 Agreement. It is one of the most basic rules of international law that a treaty binds only states which are party to it. The same question arises with regard to the application of Part IV on Non-members and Non-participants.[1] For States arguing that the 1995 Agreement does bind non parties, it will be necessary that these provisions have achieved such widespread acceptance so as to have become part of international customary law.[2]

Duties of the Flag State

Part V, starting with article 18, lays down the duties of the flag states that are parties to the agreement. It establishes the basic concept of flag state responsibility over vessels fishing on the high seas and outlines detailed provisions on the specific obligations to which a flag state must agree to and implement before its nationals are permitted to fish on the high seas and in areas managed by RFOs. This provision is worded generally: it is not limited to straddling fish stocks of highly migratory stocks. Some argue that it reflects customary international law.

Compliance and Enforcement

Provisions concerning compliance and enforcement raise many "new" points. Of particular interest is Article 21 on "Sub-regional and regional cooperation in enforcement" which applies only to the State Party . A very much debated issue relates to the boarding and inspection powers of states party of vessels flying the flags of other states party in any high seas area covered by a sub-regional or regional fisheries a management organization or arrangement. Though the concept is not new[3], many DWFN are critical vis-à-vis these provisions and in particular vis-à-vis the implementation of the enforcement procedures spelled out in articles 20-21 with regard to non-members of RFOs.

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[1] In particular see also Article 17, 2 which reads : "2. Such State (non-member and not agreeing) shall not authorize vessels flying its flag to engage in fishing operations for the straddling fish stocks or highly migratory fish stocks which are subject to the conservation and management measures established by such organization or arrangement."

[2] W.R.Edeson, see above footnote 18.

[3] Several regional fisheries arrangement such as the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), and the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea include a joint enforcement scheme allowing for boarding, inspection and subsequent investigation by inspectors of States other than the Flag State on the high seas. It is however also convenient to note that Article 21, 15 allows for an alternative mechanism other than boarding and inspection. Furthermore, the legal proceedings, penalty levels and prosecution rest still primarily the responsibility of the Flag State.

To conclude

Given the limited acceptability of the agreement at this stage it is difficult to consider the Agreement as binding on those which are not a party to it except possibly for the "general principles" and the precautionary approach. These are arguably part of customary international law; others like the duties of the flag state worded in very general terms and applying to all fishing vessels and arguably could be considered also part of an emerging rule of international customary law. Article 21 on the other hand by its terms can only apply to a State Party.

It will be apparent that many uncertain issues surrounding the precise application of the agreement on which widely different views can be expected to be held for some time to come.

CASE STUDIES

FISHERY OF SHARED STOCK OF THE SILVER POMFRET, *PAMPUS ARGENTEUS*, IN THE NORTHERN GULF; A CASE STUDY

by

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SUMMARY

Zobaidy (or silver pomfret, *Pampus argenteus*) is a prime, valuable and shared fish stock in the northern Gulf (Persian, Arabian) between Kuwait and Iran. Its catches constitute from 30 to 40 percent of the total value of Kuwait's capture fin-fish fisheries, but Kuwait catches have declined from 1 100 tonnes in 1994 to 120 tonnes in 2000. The catches and catch rates of by Iranian fleet have also decreased substantially from 1142 tonnes in 1996 to only 114 tonnes in 2000. Now it is believed that the northern Gulf's fishery stocks are under environmental stress due to high fishing capacity of fleet, and to ecological changes due to the decrease of the rivers discharges.

The available data indicate that zobaidy in the northern Gulf is comprised of one stock unit and its migration is confined to the sea area between Kuwait, Iraq and the Khuozestan Province of Iran. It is believed that the major spawning and nursery areas are located in estuaries in Iran (Shatt Al-Arab) while feeding and wintering areas are within Kuwait's waters.

A cooperative research proposal was formulated by the Kuwait Institute for Scientific Research and the Iranian Fisheries Research Organization to study jointly the status of the severely depleted zobaidy stock. The main objectives of the proposed project are to determine the standing biomass, seasonal abundance, migration patterns and other basic biological parameters necessary for management. The structure and impact of the operational fishery in the region will be investigated. The output of the project will provide baseline knowledge for the establishment of a regional cooperative management system based, as proposed, on total allowable catch (TAC) and Individual Quota system within each country. The success of any management and stock conservation plan in the region will depend entirely on effective enforcement and surveillance powers, cooperative decision-making, and accurate stock monitoring.

INTRODUCTION

Kuwait's fin-fish fishery is a multigear and multispecies fishery, operating almost year-round. A total of 3378 fishermen land an of 5 916 tonnes valued at KD $9.011X10^6$ per annum (1992-1998). The major sectors include gill netting with various mesh sizes targeting different demersal and pelagic species, trawling for penaeid shrimp species and demersal fish by-catch, and hemispherical wire traps (gargoor) targeting demersal species. The fin-fish landings are mostly derived from 11 fish species, among which are silver pomfret (*Pampus argenteus* locally known as zobaidy), orange-spotted grouper (*Epinephelus coioides*), grunt (*Pomadasys kaakan*), Hilsa shad (*Tenualosa ilisha*, locally known as suboor), tigertooth croaker (*Otolithes ruber*), yellowfin seabream (*Acanthopagrus latus*) and mullet (*Liza klunzingeri*). The fin-fish catches are landed by 732 fibre-glass speedboats (707 gill net and 25 gargoor), 84 wooden dhows (20 gill net and 64 gargoor), and as by-catch from 27 dhow and 35 steel shrimp trawlers. The actual number of operating dhow boats and speedboats, however, would be much lower than these numbers and would vary seasonally.

Two main migratory fish stocks, zobaidy and suboor, in the northern area of the Gulf are shared among Kuwait, Iraq and Iran. Both species are considered economically valuable and important for the fisheries in the region. Both life cycles, i.e. reproduction and nursery grounds, are associated with the river systems of the northern Gulf. Other shared fish stocks might exist, like grunt (*Pomadasys kaakan*), but are less defined, although it is believed that their distribution is also closely associated with estuaries.

Zobaidy (family Stromateidae), widely spread throughout the Indo-Western Pacific region, supports valuable fisheries along the coast of India (Kagwade, 1988; Pati, 1982), the eastern part of China, the western and south western Korean Peninsula (Cho *et al.*, 1989) and western Asia all the way to the Gulf. The value of the local zobaidy landed in Kuwait's fish markets in 1993 was US$9,477,000 out of the total fish value of US$ 19 410 000 of Kuwait's fish production. The catch of the Kuwaiti gillnet fleet has declined to less than 88 percent, from 1112 tonnes in 1994 to 120 tonnes (US$1 570 10^3) in 2000 (CSO, 2001).

Along the coast of western Bengal in India, zobaidy undertake spawning migrations to their breeding and nursery grounds in the north during the onset of the spawning season, and migrate to the south in the post-spawning period (Pati, 1982). Most catches of zobaidy in the East China Sea and Yellow Sea come from areas where oceanic fronts occur due to mixing of warm and cold currents (Cho *et al.*, 1989). Zobaidy migrates northward or southward according to the distribution of warm water currents thus, they migrate to the north in summer and to the south in winter.

Studies from other regions indicate that a muddy-sandy substratum is important for providing adequate habitat for foraging (Kuthalingam, 1967), while large numbers of ripe zobaidy and post-larvae are found in shallow coastal waters (Pati, 1982). Gonadal maturation indicates that zobaidy has a prolonged spawning season. The spawning season in Kuwait starts in March to April (Abu-Hakima *et al.*, 1983; Hussain and Abdullah, 1977) or peaked in May (Dadzie *et al.*, 2000a) and ends in August to September. In the Bay of Bengal, two peaks were observed: February to April and July to August (Pati, 1982), while in the eastern China Sea, the spawning peak was from May to July (Lee and Jin, 1989).

The probable distribution may be due to five important factors: water temperature, salinity, dissolved oxygen levels, currents, water clarity, and zooplankton abundance. Ichthyoplankton surveys by Dames and Moore (1983) of the northern and western part of Kuwait's waters indicate that zobaidy eggs and larvae were found throughout the year in Kuwait Bay. Larvae abundance was highest in Khor Al-Sabyiah and the northern flats of Failaka Island during the summer months between May and August. Judging from larvae concentrations around Khor Sabyiah, zobaidy appeared to reproduce mostly in late spring and summer. Few larva or eggs were collected in any other months or at other sites (Dames and Moore, 1983).

Zobaidy is a herbivore during the pelagic post-larval period. After metamorphosis, it becomes a benthopelagic carnivore (Pati, 1983) and a column feeder as it feed on copepods, which undergo diurnal vertical migrations (Pati, 1980). The main bulk of the diet of the young zobaidy is small copepods and small crustaceans, while adults feed mainly on small crustaceans at shallow depths, and polychaetes and foraminifera in deeper areas (Kuthalingam, 1967). Pati (1980) studied the stomach contents of zobaidy in the Bay of Bengal showed that copepods are the main dietary component throughout the year. Other major food items are decapod larvae, polychaetes and ctenophores. Dadzie *et al.* (2000b) study reported that copepods were dominant (39 percent) food item in zobaidy's stomach from Kuwait's waters. Bacillariophyta (21 percent), Mollusca (11 percent), fish scales (10 percent), and fish eggs and larvae were other major groups. Pati (1983) found that growth changes in the zobaidy are directly correlated with the changes in the trophic levels of the marine habitat.

Most fish species of Kuwait's fishery are prolific breeders, but any environmental changes together with heavy fishing pressure could result in a population collapse. The goals of the fisheries management program in Kuwait are to prevent this from occurring in order to provide the nation with food security.

The required stock assessment advice depends on the phase of development of a fishery and its characteristic problems and degree of complexity. Nearly 15 years ago, Kuwait's fin-fish fisheries were over developed (KISR, 1988). This situation is still characterized by over-capacity (excessive fleet size or effort), declining catch rates and total catches, and economic losses. Thus, corrective advice is needed for specific measures such as mesh size, catch quota, length of fishing season, and protection of spawning biomass or juveniles.

The United Nations Conference on Environment and Development highlighted the poor performance of existing international fisheries management organizations and increasing conflicts among nations regarding the harvesting of migratory species. Conference attendees agreed to carry out negotiations to develop more effective management regimes for these fisheries. The United Nations Conference on Straddling and Highly

Migratory Fish Stocks started meeting in 1993 to establish the best measures for sustainable management regimes for the most economically and environmentally valuable species (Doulman, 1995, see also Barston, 1995, Hayashi, 1994, Hayashi, 1995). According to the Food and Agriculture Organization (FAO) report, the world is facing a global fishing crisis at the beginning of this century. The catches are declining from their peaks during late 1980s, and most of the world's major marine fisheries are overexploited or have reached the edge of extinction, which present new challenges to fisheries management institutions around the world.

With extension of national jurisdictions and the declaration of exclusive economic zones (EEZ) of 200 miles in late 1970s, the fishing areas were limited for some large oceanic fishing fleets and conflicts about fish resources increased. Meanwhile, stock abundance and biomass decreased. Most of these fish stocks are highly migratory species dwelling across different EEZs or the territorial boundaries of adjacent countries. Hongskul (1985) classified these shared stocks into two main categories:

Stocks occurring in two or more national jurisdictions with movement across boundaries but no clear migratory patterns.

Stocks occurring in two or more national jurisdictions with a clear pattern of movement between one zone and another.

The latter stock type is the most important group and includes many significant demersal and pelagic fish species, the migration of which occurs seasonally between spawning and feeding grounds. Usually, migratory fish species exhibit seasonal cycles of migration, which take place through different national jurisdictions. Feeding and growth take place in one area while spawning occurs in another area, or possibly, development and growth occur in a third area (a nursery area). In a given area, fishing or other ecological activities including changes in ecosystem components related to the fish stock will definitely affect fisheries in other areas.

ECOLOGY OF THE NORTHERN GULF

The Gulf (also known as the Persian or Arabian Gulf) is semi-closed shallow sea, bounded by arid tropical and semi-tropical coastal area. The main source of freshwater, nutrients and fluvial inputs into the northern Gulf is from the Shatt al-Arab River (mean flow = 1 456 m^3/s) that discharges in north and formed by the confluence of Euphrates, Tigris (in Iraq) and Karun (in Iran) Rivers (see Fig. 4). The Shatt al-Arab plays a very important role in the sustenance of the economically important shrimp and finfish fisheries of the northern Gulf, with average of total annual production of $72.7X10^3$ tonnes (Kuwait, Iraq and Iran). The average primary productivity of the northwest Gulf was 152.89 mg C l^{-3} d^{-1} with a minimum of 11 and maximum of 610 using C-14 methodology (Al-Yamani *et al.*, 1997a). Phytoplankton and zooplankton productivity blooms during spring and summer in the northern Gulf, the biodiversity and biomass were the highest in the Gulf (Jones *et al.*, 2002). Significant correlations have been documented in the Gulf between the zooplankton abundance (copepods and meroplankton), which provide food for larval fish species, and eggs and larvae (Houde *et al.*, 1986).

Recent changes in the ecology and hydrobiology of the northwestern Gulf result from the destruction of vast areas of marshes in southern Mesopotamia and decrease of freshwater flow (Maltby, 1994). The marshes were formed by the confluence of the Euphrates and Tigris Rivers formally encompassing an area of 15,000 to 20 000 km^2. Massive channelization of the marshes and the upstream damming in Turkey, Syria and Iraq (Maltby, 1994) has put the associated fish stocks of the riverine and estuarine systems in jeopardy. Dams constructions will almost eliminate flooding, the main driving force for physical and biological riverine processes, and will alter the quality and quantity of water received downstream. Satellite images show that about 90 percent of wetlands have been drained, leaving only 1 500 to 2 000 km^2 remaining. Completion of all planned development in Turkey and Iraq by 2003 will reduce the Shatt Al-Arab flow to 70 percent (Maltby, 1994).

It is almost certain that annual fish migration and breeding will be disrupted due to changes in the hydrological regime and marine environment that are associated with the freshwater flow system. Consequently, this will have an impact on fish spawning activity, recruitment, and hence, stock productivity.

Furthermore, the recent construction of the Third River in Iraq has ecologically impacted the water quality of Kuwait's northern waters. This river discharges into Khor Al-Zubair, which is immediately north of Warbah and Bubyan Islands and Khor Al-Sabyiah. The impacted area exhibited lower salinity (from 38.19 to 35.04 ppt), higher nutrient levels (nitrates, phosphates, and silicates), and higher turbidity levels in 1995 to1998 than in the period from 1985 to 1993 (Al-Yamani *et al.*, 1997b). River discharge decreased in 2000 and 2001, and the salinity increased to 40.3-43.4 ppt and 43.5-44.1 ppt, respcetively. Sources of nitrates in the lower reaches of Tigris and Euphrates, as well as from the upper reaches of Shatt al-Arab, have been attributed to agricultural runoffs, discharge of sewage wastes, and increased decomposition of organic matter and release of the adsorbed nitrate (Saad, 1982).

FISHERY

Locally, zobaidy are considered the most dominant and commercially important species. This species constituted on average 25 percent of the 1991 to 1994 fish catches landed at Kuwait's fish markets (Fisheries Statistics of Central Statistical Office, Ministry of Planning, Kuwait), while most of the supply came from imports in 1985 to 1989 during the Iran-Iraq war (KISR, 1988). It accounted for only 4.3 percent of the total landings from Kuwait's catches in these years (Lee *et al.*, 1990, Mathews *et al.*, 1989).

The main operating seetor inshore and offshore for zobaidy in both Kuwait and Iran is the artisanal fleet consisting of dhow boats and speedboats using drift gillnets. The mesh size of the gill nets in use is about 140 mm. The fleet size of Khouzestan Province in Iran consists of 826 dhows (artisanal wooden vessels) and 1495 speedboats, while Kuwait's drift and gillnet fleet consists of 15 dhows and 720 speedboats. However, the actual operating boats involved in zobaidy fishery are not known in both countries. The fishery charaeteristieally operates in shallow waters of 3 to 10 m on muddy-sandy bottoms. The main fishing grounds for zobaidy in Kuwait are north and east of Failaka Island, southeast of Bubyian Island and in Khor Abdullah. Other seetors like shrimp trawlers and coastal stake nets (hadrah) eontribute small quantities to the zobaidy landings.

The main fishing seasons in Kuwait are in April to May and September to Oetober, although small quantities of zobaidy are landed during November to March either by drift gill net or shrimp trawling fisheries. In Iran, the fishing season starts in May and continues to September. Some zobaidy are landed as shrimp by-cateh during the shrimp season during the autumn and winter. The extensive fishing grounds for the shrimp *Metapenaeus affinis* are known to also overlap with the main nursery area of zobaidy in Iran, but no data are available exeept fishermen's reports indieating the severe impact of this fishery on juvenile zobaidy populations.

From 1972 to 1979, Kuwaiti landings of zobaidy averaged 715 tonnes/year, where as from 1982 to 1988, landings averaged only 300 tonnes/year (Fig. 1). This reduction was a result of the closing of fishing areas in northern Kuwaiti waters and in Iranian waters during the Iran-Iraq war. The eatches increased to an average of over 1000 t/yr after 1991, when the restrictions on fishing grounds were lifted; however, these eatehes started to deeline in 1996, dropping to 120 tonnes in 2001.

No fishery statistics were collected prior 1993 in Khouzestan Provinee, Iran. Actual research started with the establishment of a data collection system in 1993 to estimate catch and effort as well as surveys and sampling of length measurements at landing places. As a result of these preliminary studies, a 45-d ban period has been implemented to protect spawning in the presumptive spawning areas.

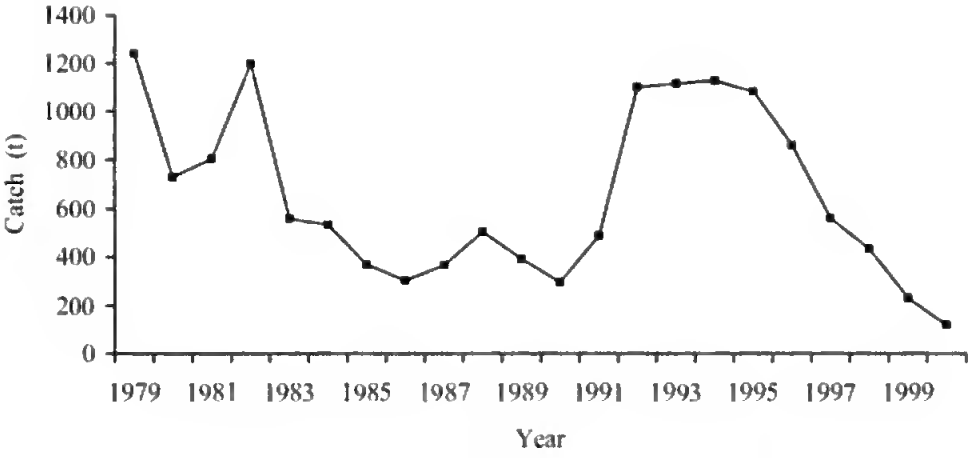

Fig. 1. Total zobaidy catch of Kuwait's fisheries, 1979 to 2000

The landings by the dhow fleet of Iran average about 591 tonnes in recent years (1998-2000), which comprises about 6 percent of Khouzestan's total catch. The recorded statistics for zobaidy landings in this province are given in Table 1. A significant fraction of the catch was not landed because it was sold illegally at sea and landed in countries (mainly Kuwait) in the Gulf (Parsamanesh *et al.*, 1996).

Table 1. Yearly Total Catch of Zobaidy Landed and Number of Speedboats and Dhows in Khouzestan Province (Iran) for the Period 1993-2000

Year	1993	1994	1995	1996	1997	1998	1999	2000
Total Catch	738.2	721.5	895.5	1142.4	1688.7	875.3	782.8	114.8
Number of Boats	1612	1872	1935	2009	2011	2052	2133	2332

The catch statistics show that the catches of the Iranian fleet more than doubled from 1993 to 1997 (Fig. 3). Concomitantly with the increased landings was an increased in the total number of boats from 1612 in 1993 to 2332 in 2000 (Fig. 2). Iranian catches of zobaidy landed at Kuwait's fish markets, however, are not reported in Iran's catch statistics. The Kuwaiti catches declined from 1112 tonnes in 1994 to 120 tonnes in 2000. Consequently, economic loss was high due to low catch rates, and hence, the number of fishermen leaving the sector increased. Parsamanesh *et al.* (2001) reported that the catch rate of zobaidy in Khouzestan fleet is also decreased from 4.0 kg/panel (or 32 kg/day) in 1993 to 0.9 kg/panel (or 8.5 kg/day) in 1999.

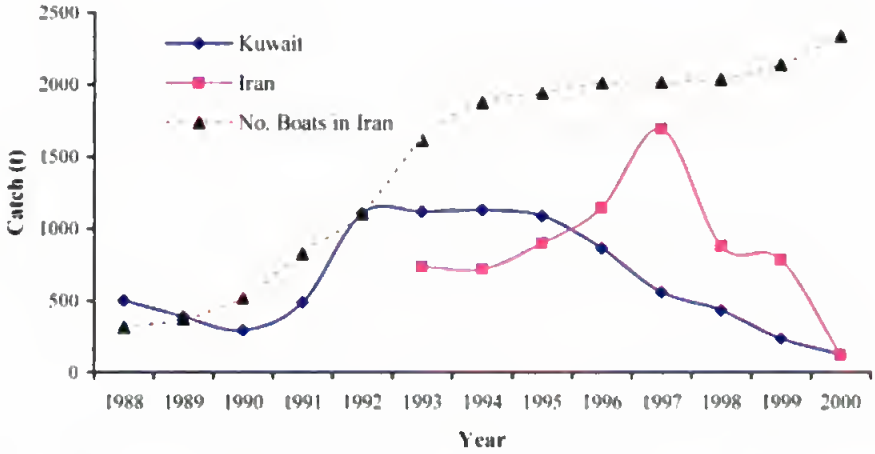

Fig. 2. Zobaidy catches landed by Kuwait's and Iran's fleets, and size of the Iranian fleet in Khouzestan Province from 1988 to 2000

STOCK ASSESSMENT

Both Kuwait and Iran exploit the zobaidy stock when it migrates to waters in the northern Gulf from March to October for spawning. During the cooler months from November to March, the stock is believed to migrate southward to deeper waters (see Fig 4). As waters warm from March to May, zobaidy adults return to spawn in estuaries at the head of the Gulf through Kuwait's waters. These areas might be also considered the main nursery area. Mature and ripe to spent zobaidy and small juveniles are also found in Kuwait's waters, but their contribution to the total spawning biomass is not known.

The nature and extent of specific nursery and spawning grounds in the northern Gulf is not fully known; however, it is believed that spawning occurs in the vicinity of the estuaries. A sub-spawning stock occurs in Kuwait's waters as indicated from sea surveys in a limited area of Kuwait Bay (Almatar, S., KISR, personal communication), while Iranian scientists confirm that spawners are found in Iranian estuaries in the northern areas of the Gulf. In addition, migration patterns and the location of feeding grounds and wintering grounds are also not fully documented. Monthly landings at Kuwait's fish markets (Fig. 3) indicate that zobaidy catches by the gillnet fishery increase during April and May in the areas of Khor Abdullah, south east of Bubyian Island, east of Failaka Island and in the eastern areas of Kuwait Bay. This distribution continues up to September and then gradually decreases. On the other hand, the catches by shrimp trawlers operating in deeper areas from south Auha Island to north of Umm Al-Maradem Island increase from October to December.

Assessment of the zobaidy stock indicated that the maximum sustainable yield (MSY) was around 500 t (Mathews *et al*, 1989). This estimate, however, was based on the 1982-87 historical catches by Kuwait's fleet when the Iran-Iraq war had limited access to fishing grounds, while average annual catches were near the MSY (422 t) during the same period. Parsamanesh *et al.* (1998) indicated that zobaidy was fished (1993 to 1995) at or near its MSY in the Khouzestan Province of Iran. All previous assessments at the Mariculture and Fisheries Department of the Kuwait Institute for Scientific Research were covered only the adults and the of the zobaidy stock in Kuwait's waters.

The results of the MSY should be applied with caution since this stock is migratory and is harvested by two countries. Recently, Iran initiated data collection on catch and effort, and, thus the actual sustainable yield may be determined collectively for the stock using data of the two countries. Presently, neither standing biomass (stock size) nor whether this stock consists of one unit or several sub-unit stocks is known.

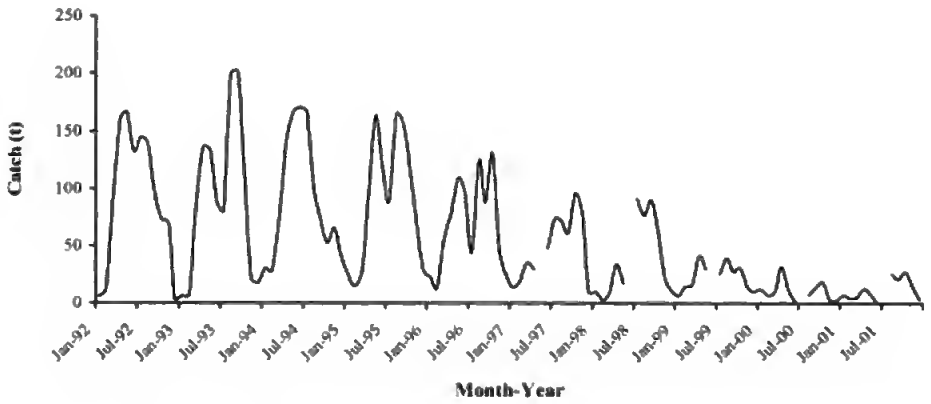

Fig. 3. Monthly zobaidy catches landed at Kuwait's fish markets from January 1992 to December 2001

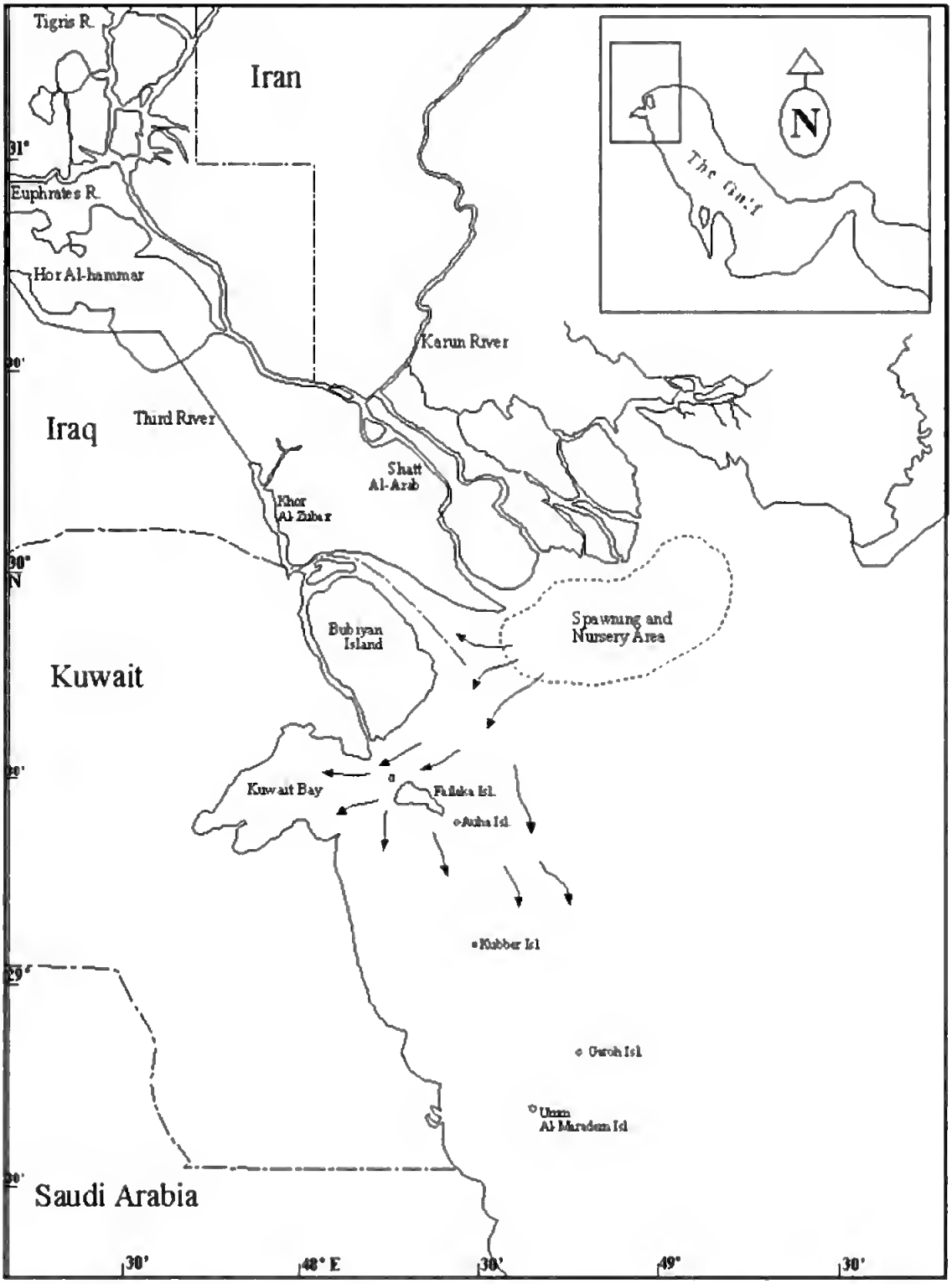

Fig. 4. Map of the Northern Gulf area showing the riverine system, zobaidy's presumed spawning and nursery area in Iran waters and migration routes (indicated as arrows) to feeding areas in Kuwait's waters during September.

All previous assessment work on zobaidy stock used length-based methods (Al-Hossaini, 1994; Lee *et al.*, 1990; Mathews *et al.*, 1989; Morgan, 1985; Parsamanesh *et al.*, 1998). Estimated von Bertalanffy growth parameters for L_∞ (asymptotic maximum length) ranged from 32 to 44.5 cm forked length and for k (growth rate) from 0.49 to 1.0 per annum. Total mortality (Z) estimates using catch- curve methods were 1.5 (Lee *et al.*, 1990), 1.62 (Morgan, 1985) and 2.4 (Al-Hossaini, 1994). Natural mortality (M) estimates varied from 0.5 to 1.05, and estimated age at first capture was one year (Lee *et al.*, 1990). The results from Khoozestan Province on length distribution analysis for 1993 to 1995 (Parsamanesh *et al.*, 1998) indicate that L_∞ varies from 35 to 42, k from 0.85 to 1.12, Z from 2.6 to 5.36 and M from 1.4 to 1.6.

Both countries now imposed a 45-day ban during May to June to protect spawning biomass, however, there is extensive fishing by the Iranian fleet after this closure in the nursery areas, and any overexploitation will affect the yield of the Kuwait fishery. Thus, cooperative research and management of this stock is recommended for future sustainable harvesting.

It is not possible to determine zobaidy age from counts of annual marks in whole otoliths or by the grinding and burning method, or by applying modal progression analysis of length-frequency samples. The results of previous assessments of the zobaidy stock in the vicinity of Kuwait were based on extensive length-frequency data analysis (Morgan, 1985).

Although ageing of another species of pomfrets, *Pampus echinogaster,* using vertebrae was successful (Kang *et al.*, 1989), attempts of using this technique with zobaidy have been unsuccessful. Microstructural analysis of zobaidy otoliths revealed that otolith ageing is difficult because of the otolith structure is very complex and the daily increments are highly irregular, making them difficult to observe and interpret (Brothers and Mathews, 1987). The only promising ageing technique is that of annual marks with a robust validation study using thin sectioning and staining.

Yield-per-recruit analysis (Morgan, 1985) indicated that optimal fork length at first capture is about 20 cm while the actual fishery figure is less than 16 cm. The same analysis with the exploitation rate showed that the stock is not heavily exploited according to data on fishing effort for1981 to 1984.

RESEARCH PLANS

The available information on zobaidy stock indicates that the two countries, Kuwait and Iran, share the stock and any damage to the stocks in one country will affect the catches in the other country. Thus, it would be highly beneficial for the two countries to formulate a mutual agreement and practice joint management of the shared stock.

Fisheries scientists initiated a research proposal for a cooperative project between the Aquaculture, Fisheries & Marine Environmental Department (MFD) of Kuwait Institute for Scientific Research, and the Khouzestan Fisheries Research Centre of the Iranian Fisheries Research Organization (IFRO). A proposal was developed over several regional meetings between the two groups of scientists, and a Memorandum of Understanding was signed the by the General Directors of the two institutes for implementing cooperative research between the two departments. The Public Authority for Agriculture and Fisheries (PAAF) of Kuwait and the Iranian Shilat Fisheries Company will also sign an agreement for cooperative fisheries management.

Identification of shared stocks is the main task for the fisheries organizations in the northern Gulf region. Properly organized management schemes and measures for these stocks require a clear understanding of baseline information including their bio-geographical and temporal distributions, migration patterns, stock biomass and unity, and occurrence of transboundary movement. Management-wise, allocation of shares (total allowable catch, TAC) for each country through negotiation requires biomass estimates, and an explicit understanding of the biological characteristics and effort trends of fishing fleets (Caddy, 1982) as well as a clear understanding of operational characteristics of the fishery (Morgan, 1997). Various legal measures may be adopted, such as size-limit regulations, catch quotas, minimum mesh size, and restrictions on fishing effort, to ensure proper sustainability of the stock.

Implementation of stock harvesting strategies and a quota system for zobaidy stocks require basic information on the biomass, seasonal abundance, migration and spawning. Abundance can be estimated by

different methods. The most reliable methods are mark-recapture experiments or cohort analysis (or virtual population analysis, VPA). Mark-recapture experimentation is an excellent method to estimate population size, survival rate and migration pattern. Tagging of zobaidy is not possible because this species is handling-sensitive once caught by fishing gear, and as a result, mass mortality is inevitable. VPA is a powerful tool for estimating population size, mortality rate and recruitment, but it is very data-intensive. The minimum data required for VPA are a catch-at-age matrix and estimates of natural mortality. Total catch, size distributions and age-length keys are the main components for constructing age composition of the catches. Age data are lacking for both countries while total catches and size distributions are lacking for Iran. Hence, these basic data need to be collected during the cooperative research project.

Sea surveys allow estimation the average fish density over a spatial range, and then the spatial distribution of the density can be mapped. Incorporation of a temporal scale (i.e. a monthly or quarterly time scale) with the spatial distributions of the relative densities can be used to ascertain the migration patterns of zobaidy.

Zobaidy is considered difficult to age by means of hard tissues such as otoliths using whole otolith reading method or grinding and burning method. Attempts were carried out at MFD to age zobaidy by microstructure analysis of otoliths (Brothers and Mathews, 1987), but the pattern of accretion of the daily increments is irregular, and therefore, increment counts are uncertain. Thin sectioning with polishing and staining will be conducted to discern the presumptive annual marks but validation of these marks needs to be conducted.

THE COOPERATIVE PROJECT

The PAAF, KISR and the Kuwait Foundation for Advancement of Science financially support Kuwait's involvement in the project (KFAS) while IFRO will support the Iranian sector of the project.

The project will start in September 2002, and last 37 months. During the seven-month mobilization period, setting of standard procedures for data collection and sampling will be established. The proposed project consists of three operational research tasks in each country and one management task in MFD. The duration of these tasks is two years. These operational tasks are:

1. *Fishery data collection:* the basic data on catch, fishing effort, and fisheries biology (length distributions, sex ratio, maturation, length-at-age, weight).
2. *Sea Surveys*: determine monthly abundance, biomass and length frequency for each proposed sampling station at sea
3. *Data analysis:* estimate monthly catch and effort, length frequency, growth and mortality estimates, biomass and seasonal distributions, migration pattern, maturity, recruitment, and yield forecast.

The final six months will be spent analyzing data and writing the final report.

MANAGEMENT PROSPECT FOR ZOBAIDY STOCK

The success of implementation of the management plan, which will be based on project results, depends on the developmental stage and powered enforcement of the fisheries institutions in the two countries. The sharp decline of catches of zobaidy in the region is a worrying indication of diminishing stock abundance and all concerned parties should implement the resulting management program immediately to protect stock from further reduction or collapse. The project will encourage the two countries in the region in the following aspects:

1. Improve the political will for management organizations in the region for cooperative management.
2. Strengthen institutional research in terms of scientific advice to the management organizations and decision-making authorities.
3. Improve effective enforcement and surveillance power by the two management authorities (PAAF and Shilat) to ensure prevention of illegal fishing and catch transfer through marine borders.

4. Establish a joint stock monitoring system if the data show year-to-year variation of spawning biomass and migration pattern.
5. Establish biological reference points for the zobaidy to prevent further over-fishing and initiate recovery measures.
6. Establish a management system to ensure equitable distribution between the countries and to ensure long-term maintenance of the stock
7. Establish a management system within the countries based on Individual Transferable Quota (ITQ).

REFERENCES

Abu-Hakima, R; K.M. Al-Abdul Elah; C. El-Zaher; and S. Akatsu. 1983. The reproductive biology of *Pampus argenteus* (Euphrasen) (Family: Stromateidae) in Kuwait waters. Kuwait Institute for Scientific Research, Report No. 998, Kuwait.

Al-Hossaini, M., 1994, Fin-fish and shrimp fisheries management, Food 4. Kuwait Institute for Scientific Research, Report No. 4367, Kuwait.

Al-Yamani, F.; R. Durvasula; W. Ismail; K. Al-Rifaie; T. Al-Saeed; A. Al-Yaqout; and L. Al-Omran. 1997a. Dynamic Oceanography of the northwestern waters of the Arabian Gulf: Ecological significance of the marine food web. Kuwait Institute for Scientific Research, Report No. 5173, Kuwait.

Al-Yamani, F. Y., Bishop, J., Al-Rifaei, K., Ismail, W., Al-Yaqout, A., Al-Omran, L., Kwarteng, A., Al-Ghadban, A., & Sheppard, C., 1997b. Assessment of the effects of the Shatt al-Arab's Altered Discharge Regimes on the Ecology of the Northern Arabian Gulf. Final Report. Kuwait Institute for Scientific Research, Report No. KISR 5174, Kuwait.

Barston, R. 1995. United Nations conference on straddling and highly migratory fish stocks. *Marine Policy* 19: 159-166.

Brothers, E., and C. P. Mathews. 1987. Application of otolith microstructural studies to age determination of some commercially valuable fish of the Arabian Gulf. *Kuwait Bulletin of Marine Science* **9**: 127-157.

Caddy, J. F. 1982. Some considerations relevant to the definition of shared stocks and their allocation between adjacent economic zones. Food and Agricultural Organization Fisheries Circular No. 749, Rome.

Cho, K. D.; J. C. Kim and Y. K. Choe. 1989. Studies on the biology of pomfrets, *Pampus* spp. in the Korean waters. 5. Distribution and fishing condition. Bulletin of Korean Fisheries Society 22: 294- 305. (in Korean)

CSO. 2001. Fisheries statistics, 2000, Ministry of planning, Kuwait.

Dadzie, S., F. Abou-Seedo, T. Al-Shalal. 2000a. Reproductive biology of the silver pomfret, *Pampus argenteus* (Euphrasen), in Kuwait waters. *Journal of Applied Ichthyology* 16: 247-253.
Dadzie, S., F. Abou-Seedo, E. Al-Qattan. 2000b. The food habits of the silver pomfret, *Pampus argenteus* (Euphrasen), in Kuwait waters. *Journal of Applied Ichthyology* 16: 61-67.

Dames & Moore. 1983. Aquatic biology investigation studies for Subiya area, Kuwait Bay and development of electrical networks. Ministry of Electricity and Water contract No. MEW/Cp/PGP-1113-80/81, Kuwait.

Doulman, D. J. 1995. Structure and process of the 1993-1995 United Nations conference on straddling fish stocks and highly migratory fish stocks . Food and Agricultural Organization Fisheries Circular No. 898, Rome.

Hayashi, M. 1994. United Nations conference on straddling fish stocks and highly migratory fish stocks: An analysis of the 1993 sessions. *Ocean-Year Book* 11: 20-45.

Hayashi, M. 1995. The 1995 agreement on the conservation and management of straddling and highly migratory fish stocks: Significance for the Law of the Sea convention. *Ocean Coastal Management* 29: 51-69.

Hongskul, V. 1985. Considerations on management of shared stocks. Report of the FAO/SEAFDEC Workshop on Shared Stocks in Southeast Asia, Bangkok, 18- 22 February 1985, FAO Fisheries Report No. 337, Rome.

Houde, E. D., Almatar, S. Leak, J. C. Dowd, C. E.1986. Ichthyoplankton abundance and diversity in the Western Arabian Gulf. *Kuwait Bulletin of Marine Science* 8: 107-393.

Hussain, N.A., and M.A.S. Abdullah. 1977. The length-weight relationship, spawning season and food habits of six commercial fishes in Kuwait waters. *Indian Journal of Fisheries* 24: 181- 194.

Jones, D. A., Price, A. R. G., Al-Yamani, F., Al-Zaidan, A. 2002. Coastal and marine ecology. In: Khan, N. Y., Munawar, M., Price, A. R. G. (Eds.), The Gulf ecosystem: Health and sustainability, pages 65-103, Ecovision World Monograph Series, Backhuys Publishers, Leiden, The Netherlands.

Kagwade, P.V. 1988. Pomfret resources along north-west coast of India, In Living Resources of the Indian Seas, Bombay Research Centre, Central Marine Fisheries Research Institute, Bombay, India, pages 219- 224.

Kang, Y.J.; D.W. Lee; B.Q. Hong; and Y.S. Kim. 1989. Studies on the biology of pomfrets, *Pampus* spp. in the Korean waters. 3. Age and growth of Korean Pomfret, *Pampus echinogaster*. *Bulletin of Korean Fisheries Society* 22: 294- 305. (in Korean).

KISR. 1988. Strategic framework and master plan for fisheries development in Kuwait, Vol. I: The present status of Kuwait's fishing industry, Kuwait Institute for Scientific Research, Report No.2907, Kuwait.

Kuthalingam, M.D.K. 1967. Observation on the fishery and biology of the silver pomfret *Pampus argenteus* (Euphasen) from the Bay of Bengal. *Indian Journal of Fisheries* 10A: 59-74.

Lee, J.U.; M. Samuel; F.Y. Al-Yamani; and P.S. Joseph. 1990. Fin fisheries management project phase IV, Kuwait Institute for Scientific Research, Report No. 3484, Kuwait.

Lee, T.Y.; and J.J. Jin. 1989. Studies on the biology of pomfrets, *Pampus* spp. in the Korean waters. 2. Gonadal maturation and spawning. *Bulletin of Korean Fisheries Society* 22: 266- 280. (in Korean).

Maltby, E. 1994. An environmental and ecological study of the marshlands of the Mesopotamia. AMAR Appeal and Exeter Enterprises Limited, University of Exeter.

Mathews, C.P.; J.U. Lee; M. Samuel; and P.J. Joseph. 1989. Fin fisheries management project phase III, Kuwait Institute for Scientific Research, Report No. 2943, Kuwait.

Morgan, G.R. 1985, Stock assessment of the pomfret (*Pampus argenteus*) in Kuwait waters. *J. Cons. int. Explor. Mer.* 42: 3-10.

Morgan, G.R. 1997. Individual quota management in fisheries. FAO Fisheries Technical Paper 371, Food and Agriculture Organization of the United Nation, Rome, Italy.

Parsamanesh, A., Shalbaf, M. R., Eskandari, Gh., Kashi, M T. 2001. Stock assessment of Khouzestan fishes (1379). Khouzestan Fisheries Research Centre, Iranian Fisheries Research Organization, Report, No. 79-07103380000-06, pp. 71.

Parsamanesh, A.; M. Shalbaf; and M. Kashi. 1996. Stock assessment of Khoozestan Province fishes in 1995. Iranian Fisheries Research and Training Institute, Ahvaz, Iran.

Parsamanesh, A.; M. Shalbaf; and N. Najafpour. 1998. On the status *of Pampus argenteus* fisheries in Khoozestan waters (North-West Persian GULF), I. R. Iran. *Indian Journal of Animal Science* 68: 407-409.

Pati, S. 1980. Food and feeding habits of silver pomfret *Pampus argenteus* (Euphrasen) from Bay of Bengal with a note on its signifieanee in fishery. *Indian Journal of Fisheries* 27: 244- 257.

Pati, S. 1982. Studies on the maturation spawning and migration of silver pomfret, *Pampus argenteus* (Euphrasen) from Bay of Bengal. *Matsya* 8: 12-22.

Pati, S. 1983. Growth changes in relation to food habits of silver pomfret, *Pampus argenteus* (Euphrasen). *Indian Journal of Animal Science* 53: 53-56.

Saad, M. A. H. 1982. Distribution of nutrient salts in the lower reaches of the Tigris and Euphrates, Iraq. *Water Supply and Management* 6: 443-453.

COOPERATIVE MANAGEMENT OF SHARED FISH STOCKS IN THE SOUTH PACIFIC

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INTRODUCTION

The management of shared fish stocks presents peculiar problems for fisheries managers because these stocks are not stationary. They move from one jurisdictional zone to another therefore it is not possible to manage such stocks unilaterally. The problem of managing shared fish stocks is that even if one country promulgates effective management and conservation measures, such measures can be undermined by uncontrolled fishing in a neighbouring country's waters or in the adjacent high seas.

The need for cooperative management of shared fish stocks underpin the principles found in article 63[1] and 64 of the 1982 *United Nations Convention on the Law of the Sea* (LOSC), and article 7 of the 1995 *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* (UN Fish Stocks Agreement). The challenge for States Parties to these instruments is to structure joint fisheries management arrangements in a way that facilitate effective conservation and management of shared fish stocks.

The purpose of this paper is to describe cooperative management of shared stocks in the South Pacific[2]. The most commonly shared fish stock in the South Pacific is tuna. Tuna is not only a shared fish stock, thus subject to the regime under article 63 of the LOSC, it is also a highly migratory fish stock which makes it subject to article 64 of the LOSC. By way of background, the paper begins by describing the geo-political characteristics of the region. This is essential to understanding cooperative management of shared tuna stocks in the region. This is followed by a discussion of the policy, management and legal approaches to tuna management in the South Pacific. The paper then discusses some contemporary issues pertaining to cooperative tuna fisheries management and future challenges to co-management of shared stocks in the South Pacific. The paper concludes that while cooperative management of shared stocks is essential, it is imperative that all interested States have a common objective in managing the stocks.

THE TUNA FISHERY OF THE SOUTH PACIFIC: ITS GEO-POLITICAL FEATURES

Generally, the countries of the South Pacific share the same physical, economic and political characteristics. They are small, scattered across some 35 million square kilometres of ocean space, isolated from each other and the major metropolitan markets, and tend to have a narrowly defined economic base. The combined landmass of the countries is only 2 percent of the total area of the region or the equivalent of 500,000 square kilometres. The largest is Papua New Guinea, which is approximately 330,000 square kilometres. In contrast, Tuvalu is only 26 square kilometres.

The countries are relatively young in political terms. The oldest is Samoa, which gained independence in 1962. The youngest is Palau, which only became independent in 1994. All countries enjoy constitutional

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[1] Art. 63 of the 1982 United Nations Convention on the Law of the Sea states as follows:

[2] For the purpose of this paper reference to the South Pacific shall be taken to mean the waters of the States and territories members of the South Pacific Forum Fisheries Agency. These are: Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. Tokelau's application has recently been accepted by the Forum Fisheries Committee at its 51st meeting in May 2002 and a recommendation has been made to the Pacific Islands Forum Leaders

democracy and universal suffrage with the exception of Tonga in which parliamentary elections is largely restricted to Nobles. Only 9 seats are allocated to commoners. For the most part, the countries are relatively free of political strife that has beset other nations. However, in recent years a number of countries, notably Solomon Islands, Papua New Guinea and Fiji have undergone constitutional difficulties. In 2000, there were coups in Fiji and Solomon Islands and in Papua New Guinea, problems with mutinous members of its Defence Force has compelled the political government to reverse decisions it has made on both the economy and structural reforms. Regional problems are dealt with under the auspices of the Pacific Islands Leaders Forum, a non-formal annual gathering of heads of governments of the Pacific Islands.

The Pacific Islands Leaders Forum affords the heads of governments the opportunity to discuss regional and national problems, identify solutions, and assist where necessary with the mechanisms to solve those problems. Regional problems and issues of concern therefore receive the highest political blessing from regional leaders. The need to tackle problems on a regional basis permeates every issue. The countries are small and because of their limited resources, they recognize that to maximize their resources they need to act in concert with each other. The fact that there are few issues on which each country dispute also helps. The Leaders can therefore discuss their problems frankly and freely. In terms of fisheries issues, disagreements that cannot be resolved by officials are normally taken to the Leaders to address. This ensures that issues receive the highest political consideration. The existence of a stable and coherent political structure within the region has facilitated cooperative fisheries management.

Differences of opinions and policies between the South Pacific countries have not resulted in conflict. Often disagreements are discussed openly and settled through a process of consensus commonly referred to as the "Pacific Way". The machinations of the Pacific Way are often hard to describe, but it generally refers to the process through which decisions are arrived at through consultations and consensus. Divergent national interests are often discussed and resolved to serve the collective interests of the region. Conversely, regional interests can often be changed to suit situations where the national interest of one country is not consistent with regional policies. The process of consultations, however, which the South Pacific countries have developed is unique and reflect the cultural and traditional values of Pacific Islanders. These values inculcate in them a sense of consensus and consultations, which ultimately enable differences between to be discussed amiably and resolved amicably.[1]

The key shared stocks in the South Pacific are tuna. Tuna is defined as a highly migratory resource and is listed in Annex I of the LOSC. The four key tuna species that are of commercial value, and are the subject of cooperative management arrangements in the South Pacific are skipjack (*katsuwonus pelamis*), yellowfin (*Thunnus albacares*), albacore (*Thunnus alalunga*), and bigeye (*Thunnus obesus*). The fishery is dominated by three main gear types, namely, purse seining, longlining and to a smaller extent pole-and-lining. The largest fishery in terms of the volume of catch is taken by the purse seine fishery. The preliminary estimate of the 2000 purse seine catch was 1 038 748 tonnes. This represents an increase of approximately 1 percent compared to the estimated 1999 catch of 1 02 450 tonnes. The breakdown by species of the 2000 catch is as follows: skipjack 812 880 tonnes (up 4 percent from 1999), yellowfin 19 159 tonnes (down 8 percent); bigeye 28 745 tonnes (down 15 percent).[2]

In 2001, the Oceanic Fisheries Program (OFP) of the Secretariat of the Pacific Community (SPC), the premier organization providing scientific advice to the South Pacific countries reported that the total catch of the four main species (South Pacific albacore, bigeye, skipjack and yellowfin) was 1 914 149 tonnes. It was the second highest after the 2 038 584 tonnes record of 1998. The dominating species was skipjack with a catch of about 1 203 099 tonnes (63 percent) for 2001. This was slightly lower than 2000 and well below the 1998 catch of 1 317 736 tonnes Yellowfin catch was 475 501 tonnes (25 percent) and it was the highest since the record catch of 494 447 tonnes in 1998 and continue to comprise 35-40 percent of the global catch. The bigeye catch was 115 392 tonnes (6 percent) and albacore was 117 167 tonnes (6 percent), both species

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[1] See Neemia Ueetabo, *cooperation and Conflict: Costs, Benefits and National Interests in Pacific Regional cooperation*, (Suva: Institute of Pacific Studies, 1986)

[2] Forum Fisheries Agency, *Economic Overview of the Tuna Fishery*, Paper presented at the 4th Standing Committee on Tuna and Billfish, 9-16 August 2001, Noumea, New Caledonia.

catches were similar to the 2000 levels, but not as high as the catches taken in 1999 (115 768 tonnes) and 147 789 tonnes respectively).[1]

Cooperation is fundamental to management of the tuna in the South Pacific because ninety percent of the tuna is caught by vessels from Japan, Taiwan (Province of China), Korea, United States, and to a lesser extent by vessels from Indonesia, Philippines and China. European Union (EU) vessels (mainly Spanish owned) started fishing in 1999. A recent agreement signed between the EU and Government of Kiribati will see an increase in the number of EU vessels in the region. There are also vessels which are flag of convenience (FOC) vessels operating in the South Pacific. Most of these vessels are located, and land their catch in the region. Most of the catch eventually ends up in the Japanese sashimi market. The FOC vessels are mainly from Honduras, Belize, Panama and St. Lucia.

The fisheries interaction between the governments of the States whose nationals dominate the fishery and the governments of the South Pacific countries provide an important political and economic link between the two sides. The two sides do not often share the same common vision on how the tuna resource should be managed. Understanding the different dynamics at play in the fishery and the diverse national interests at stake, is fundamental to appreciating how regional cooperation has been shaped in the South Pacific. Cooperation can be seen at two different levels, namely, internal and external. Internal cooperation is the interaction amongst the South Pacific countries themselves, and the common position and initiatives taken to address fisheries problems. External cooperation is the interaction between the South Pacific countries and distant water fishing nations. This may be manifested through bilateral dialogue, or through subregional or regional forums.

The next section of this paper will look at the policy framework within which South Pacific countries manage shared stocks. This will be followed by a discussion of the achievements of cooperative management of shared stocks in the South Pacific.

THE POLICY FRAMEWORK: THE SOUTH PACIFIC FORUM FISHERIES AGENCY

The vehicle through which cooperation is pursued in the South Pacific is the South Pacific Forum Fisheries Agency. The Agency is a subsidiary body that reports annually to the Pacific Islands Leaders Forum. The Agency was established in 1979 and has a facilitative and coordinating role amongst its members, all of whom are coastal States within the South Pacific region, to manage and conserve the tuna resource. The Agency does not have any fisheries management and conservation responsibilities. Neither can it enforce decisions reached by its governing council. It merely provides a vehicle for South Pacific countries to consult with each other on matters of common interest to them with regards to the tuna resource. The Agency consists of a Secretariat which is located in Honiara, Solomon Islands, and a governing council known as the Forum Fisheries Committee consisting of representatives from all the South Pacific countries. In addition to providing a forum for South Pacific countries to consult on fisheries matters, the Committee is charged by Convention to promote intra-regional coordination and cooperation in: -

Harmonization of policies with respect to fisheries management;
Cooperation in respect of relations with distant water fishing nations;
Cooperation in surveillance and enforcement;
Cooperation in respect of onshore fish processing;
Cooperation in marketing; and
Cooperation in respect of access to the 200 mile zones of other Parties.

Technical and policy input upon which management and conservation decisions can be taken by the Committee is provided by the Secretariat. By Convention, the Secretariat is required to: -

- collect, analyse, evaluate and disseminate to Parties relevant statistical and biological information with respect to the living marine resources of the region and in particular the highly migratory species;

[1] Report of the Standing

- collect and disseminate to Parties relevant information concerning management procedures, legislation and agreements adopted by other countries both within and beyond the region;
- collect and disseminate to Parties relevant information on prices, shipping, processing and marketing of fish and fish products;
- provide, on request, to any Party technical advice and information, assistance in the development of fisheries policies and negotiations, and assistance in the issue of licences, the collection of fees or in matters pertaining to surveillance and enforcement;
- seek to establish working arrangements with relevant regional and international organisations, particularly the South Pacific Commission; and
- undertake such other functions as the Committee may decide.

While this arrangement has served the South Pacific countries well, it is recognized that effective cooperation for the conservation and optimum utilization of the highly migratory species of the region will require the establishment of additional international machinery to provide for cooperation between all States in the region and all States involved in the harvesting of such resources.[1]

While the Agency provides scientific and policy advice to the South Pacific countries, scientific analyses and research is provided by the Oceanic Fisheries Programme (OFP) of the Secretariat of the Pacific Community (SPC). An annual colloquium is convened between the Agency and SPC at which issues concerning the work programme of the two organizations are discussed. The SPC is invariably represented at meetings of the Agency. Although the composition of the SPC is slightly different from the Agency because amongst its members are the United States, United Kingdom, France and their territories and dependencies, there is close collaboration between the two organizations with regards to the provision of scientific and policy advice for conservation and management of the resource.

The close nexus between the Secretariat of the Agency, its governing council (FFC) and the fact that FFC reports annually to the Pacific Islands Leaders Forum ensures that issues of concern receive the highest political attention. The interaction between the technical aspects of the Agency's work programme, the clear policy directives provided by FFC together with its direct links to the highest political body in the region ensures that conservation and management issues concerning the tuna resource are addressed.

The following section discusses the achievements of the Agency in various aspects of management of shared stocks.

ACHIEVEMENTS OF THE AGENCY

POLICY HARMONIZATION

South Pacific countries have been able to harmonize their policies with respect to a number of measures that aim to control and monitor the activities of fishing vessels that target the tuna resource. While these policies are developed regionally and receive political endorsement by the Pacific Islands Forum Leaders, the actual implementation of these policies at an operational level are left to individual countries to incorporate in their domestic fisheries legislation's.

Vessel Monitoring System (VMS): The VMS is a satellite-based vessel monitoring system that provides countries with near-time vessel position reports. A major characteristic of the tuna fishery in the South Pacific is the highly mobile nature of the fleets, and the multi-access arrangements that exist within the region. Most of the fishing vessels have access to more than one South Pacific country which raises difficulties for monitoring and control. While most of the EEZs in the South Pacific are contiguous, there are several high seas pockets in which fishing vessels operate. It is not unusual for fishing vessels to report their catch in these high seas pockets when in fact they have been fishing in the EEZ. Such misreporting of catch tends to distort information on fishing effort. This can have serious implications for fisheries

[1] Art. III(2) South Pacific Forum Fisheries Agency Convention

management decisions. The hub of the VMS is located within the Secretariat of the Agency and is hooked up to all the Fisheries Departments of the South Pacific countries. The system enables the Fisheries Departments to monitor the activities of all the licensed vessels operating in their EEZs.

One of the drawbacks of the system is that it does not allow licensing countries to view vessels that are not licensed but are transiting through their waters. Discussions, however, are currently ongoing to develop a RADARSTAT system that would allow all vessels to be monitored through satellite visual technology. The Agency operates a VMS Register of Foreign Fishing Vessels. The regulations stipulated in the Register require all vessels wishing to fish in the region to register their automatic location communicator (ALC). The application form contains details about the ALCs Inmarsat Serial number and Inmarsat Mobile Number and information about the vessel, its call sign including confirmation of its installation by an authorized installer. Currently the system is designed to monitor the position of foreign fishing vessels. Plans are already in train to develop the system to enable countries to monitor catches and extend the system to domestic vessels.

Minimum Terms and Conditions: The Harmonized Minimum Terms and Conditions (MTCs) of Access for Foreign Fishing Vessels provides a list of conditions which the South Pacific countries are required to apply to all foreign fishing vessels operating in the region. The MTCs generally follow the measures stipulated in article 62(4) of the LOSC with respect to the conditions which may be imposed by coastal States on foreign fishing in the EEZ. The purpose and objective of the MTCs was to bring foreign fishing in the South Pacific region under some form of control and because most of the fishing vessels operated in more than one country, its application regionally ensured its effectiveness as an instrument to deal with the fishery. The application and implementation of the MTCs is left to each individual country. This is done through legislation or application through access agreements.

Transshipment: In the 1980s, high seas transshipment of catch taken in the EEZ of the South Pacific countries was difficult to monitor. The management problem created by high seas transshipment was distortion in catch levels which created difficulties for estimating the volume of catch. It was not possible to calculate the volume of catch. This caused problems for access agreements for which the rate of return was based on the value of the landed catch. In the late 1980s, South Pacific countries agreed to control and monitor transshipment by banning at sea transshipment. They agreed to the principle that no operator of a foreign fishing vessel shall transship at sea under any circumstances except for the transfer of catch by a licensed group seiner to its licensed carrier vessel. Transshipment is only to take place at a time, port and approved designated areas authorized for transshipment by the licensing country. Foreign fishing vessels are required to provide at least 72 hours notice of its intention to transship. The notification must include the name of the vessel, its international radio call sign, its position, the catch on board by species, the time and port where such transshipment is requested to occur and an undertaking to pay all the requisite fees.

Monitoring, Control and Surveillance: A high degree of cooperation exists within the framework of the Agency with respect to both the physical and non-physical aspects of monitoring, control and surveillance (MCS). The Niue Treaty on Fisheries Surveillance and Law Enforcement provides a framework under which two or more South Pacific countries can develop subsidiary arrangements to cooperate in the use of their respective physical enforcement platforms, particularly the use of their patrol boats. One of the innovative aspects of the Treaty is that South Pacific countries can allow fishing vessels pursued by a patrol boat from a country with which it has a subsidiary agreement to effectuate an arrest in its territorial waters. The Treaty is coordinated by the Agency and provides for South Pacific countries to exchange information on the operation of fishing vessels in their EEZs.

The South Pacific countries have also harmonized the requirements for enforcement, which are to be found in their legislation's. These relate to the powers of authorized officers as well as to vessel marking requirements to differentiate between licensed and unlicensed vessels.

Reporting, Catch Reports and Data Collection: A high degree of harmonization has been achieved with the modalities of providing catch reports and the collection of data from foreign fishing vessels. South Pacific countries license foreign fishing vessels using a common regional licence form. A recent addition to the requirement is that no foreign fishing vessel is to be licensed unless the vessel has good standing both on the VMS Register of Foreign Fishing Vessels and the Regional Register of Foreign Fishing Vessels. Both

Registers are maintained by the Agency. To obtain a better picture of the fishery the operators of foreign fishing vessels are required to complete in the English language daily reports of all catch, and by-catch caught in the EEZ and high seas. The Reports must be provided weekly and daily while in the EEZ. The Reports must cover such information as the vessel name, international radio call sign, licence number, position, and catch on board.

Observers: Another area in which the South Pacific countries have harmonized their policy is in the use of observers. Observers have a very important part to play in monitoring and carrying out scientific investigations on the fishery. South Pacific countries require the operators of foreign fishing vessels to ensure there is 20 percent observer coverage of all fishing trips. Observers are empowered to board the vessel for scientific, compliance and monitoring purposes. The operators must give them full access to the bridge, fish on board, and areas, which may be used to hold, process, weigh and store fish. The operator is required to meet the full costs associated with the placement of observers including full insurance coverage and salary of the observer.

Establishment of Limits through the Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery: A number of South Pacific countries have cooperated to limit the number of purse seine vessels fishing in the region. The instrument through which such cooperation is exercised is through the Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery. Under the Arrangement, the Parties have agreed to license up to 205 purse seine vessels at any one time. The licenses are allocated to fleets from Japan, United States, Taiwan, Korea, domestically-based vessels from the Philippines[1] and a special characterization of vessels belonging to the domestic fleets of the Parties and members of the South Pacific Forum Fisheries Agency.

The Arrangement is currently being reviewed and the vessel licence limitation by fleet will be replaced by a system based on vessel days. The vessel days will be allocated to the Parties instead of being shared amongst the fleets. The Arrangement is a classical management instrument, which illustrates attempts in the South Pacific to manage, shared stocks. It has both conservation objectives, namely to prevent the overexploitation of stocks, and an economic objective, viz, to maximize the value of the licenees and create competition amongst the fleets for the licences.

Reciprocal Access through the Federated States of Micronesia Arrangement for Regional Fisheries Access: The Federated States of Micronesia Arrangement for Regional Fisheries Access (FSM Arrangement) is a manifestation of the harmonization of South Pacific countries policies to provide preferential access to purse seine vessels that are domestically based, land all their catch in the region and are involved in investment that provide direct and indirect benefits to the region. Vessels that fish under the FSM Arrangement are required to carry FFA approved ALCs, and provide regular reports on their catch, landings, and transshipment to the Administrator, who is the Director of the FFA, the licensing Party and the Party where the vessel is based.

Management Harmonization

The South Pacific countries have also been cooperating to harmonize management approaches at the domestic level with respect to shared stocks. Three key areas in which the countries have been actively harmonizing management initiatives of shared stocks is through the formulation of tuna management and development plans, fisheries legislation's and the clarification of port State rights to enforcement.

Tuna management and development plans: With the assistance of the Agency, countries are now moving towards the establishment of a comprehensive framework for the management and conservation of shared stocks, in particular tuna. A number of countries have completed tuna management and development plans.[2] A key feature of the plans is the provision of guidelines for its development and investment in the fishery, guidelines for the collection of data, and recognition of the importance of cooperation. As an example of the

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[1] The locally based purse seine vessels from the Philippines are those based in one or more of the Parties.

[2] South Pacific countries that have tuna management and development plans are: Cook Islands, Federated States of Micronesia, Fiji, Palau, Papua New Guinea, Solomon Islands, Tonga, Tuvalu and Vanuatu

objectives of the plans, the following objectives of the Fiji Tuna Management and Development Plan is illustrative of the goals of such plans: -

- to provide for maximum sustainable benefits to Fiji from the resource.

- setting the harvest levels at a level that will not damage the stock and putting into practice a licensing policy that will ensure the maximum benefits from fishing are enjoyed by Fijians.

- to help improve the disparity within the segments of the Fijian population by providing preferential criteria for Indigenous Fijians to have access to licenses consistent with the aims of the government through the Social Justice Act.

In Papua New Guinea, the objective of its Tuna Management Plan is to: -

- to give effect to the fisheries management objectives and principles contained in the *Fisheries Management Act*, and specifically to:

- Maximize benefits to Papua New Guinea from sustainable use of its tuna resource,
- Satisfy Papua New Guinea's regional and international obligations in regard to the management and conservation of tuna resources, while holding the country's national interests paramount;

- Minimize any adverse impacts of tuna fishing and related activities on the marine environment;

- Minimize any adverse impacts on the non-industrial sectors, including the artisanal and traditional sectors;
- Improve decision-making in relation to the tuna fishery through effective communications; and,

- Ensure that the provisions of this Plan are developed, implemented, administered and monitored in an efficient and cost-effective manner

Harmonization of Fisheries Legislation's: It is vital when dealing with a common stock that countries in whose waters those stocks are found have the same management regime. South Pacific countries are now revising their fisheries legislation's to make them more comprehensive, and to provide a framework that would enable them to implement principles of ecological and sustainable development in the management of shared stocks. Through the Agency, South Pacific countries are ensuring the development of common provisions with respect to the application and implementation of conservation and management principles in the EEZ. Typical of recent legislation's is the provision for the application of the precautionary approach and prescription of processes that would ensure the holistic management of resources. This includes recognition of the interest of stakeholders and the need for wider consultations including fishing States in the management of shared stocks.

Port State Enforcement Provisions: A common approach to port State enforcement adopted in the region is what is known as the Lacy Act type provisions. The Lacey Act is a United States legislation, which prohibits the cross border importation of wildlife caught illegally in another State. The South Pacific countries have borrowed the idea from the US, which makes it illegal to import fish taken illegally from another State's waters. The offence is found in the importation of illegally caught fish, and not in its illegal taking in a third State. An example of such a provision can be found in section 56 of the Solomon Islands *Fisheries Act* 1998. Section 56 of the Act provides as follows: -

(1) Subject to subsection (3), a person who –

(a) on his own account, or as partner, agent or employee of another person, lands, imports, exports, transports, sells, receives, acquires or purchases; or

(b) causes or permits a person acting on his behalf, or uses a fishing vessel, to land, import, export, transport, sell, receive, acquire or purchase,

any fish taken, possessed, transported or sold contrary to the law of another State shall be guilty of an offence and shall be liable to a fine not exceeding one million dollars.

(2) This section does not apply to fish taken on the high seas contrary to the laws of another State where Solomon Islands do not recognise the jurisdiction of that State to extend to the high seas.

(3) Where there is an agreement with another State relating to an offence referred to in subsection (1) (b), the penalty provided by subsection (1), or any portion of it according to the terms of the agreement, shall, after all the costs and expenses have been deducted, be remitted to that State according to the terms of the agreement

The incorporation of these provisions in legislation is complemented by training conducted by the Agency in dockside boarding and inspection to enhance the skills of fisheries and enforcement officers in detecting violations.

ACCESS HARMONIZATION

Access harmonization in the context of cooperative management refers to the collapsing by the South Pacific countries of their EEZs for the purpose of access so that the same degree of limits apply to all vessels operating within the access harmonization regime. The classical example of such collaboration in the region is the *Treaty on Fisheries between the Governments of certain Pacific Island States and the Government of the United States*. Under the Treaty, the United States Government and tuna industry pay for the right to fish. In consideration of payment of such fees, the South Pacific countries agree to provide access for up to 40 US purse seiners in their EEZs. US purse seiners operate in all sixteen EEZs of the South Pacific countries on similar terms and conditions although individual reporting requirements have to be complied with when fishing in the EEZs.

CHALLENGES TO COOPERATIVE MANAGEMENT OF SHARED STOCKS IN THE SOUTH PACIFIC

Cooperative management of shared stocks in the South Pacific is manifested through a mixture of political, legal and economic instruments spawned under the auspices of the South Pacific Forum Fisheries Agency. It is beyond the scope of this paper to explore the effectiveness of these instruments in terms of achieving their objectives suffice to say that the tuna resource is still largely healthy. The only exception is bigeye tuna, which according to scientists from the OFP may be nearing overexploitation. Cooperative management in the South Pacific has been highly successful because of a number of factors. Firstly, membership of the Agency is largely restricted to coastal States who share the same economic interests and conservation and management objectives. Internally, therefore they do not need to negotiate and go through a complex political process in order to arrive at decisions. Secondly, the countries all have similar political structures and experiences. With the exception of Tonga, all the countries were either colonized by Great Britain, United States, Australia and New Zealand. Most of them became independent at the same time, and in particular, at the time when the UN Conference on the Law of the Sea was discussing the concept of extended maritime jurisdictions. They all shared the common view that the EEZ provided them with hope for economic independence. Thirdly, they shared similar problems in that they were all young, newly independent and lacked resources necessary to manage the resources. Thus, they saw regional cooperation as a means to an end. The end was maximization of the economic benefits from the shared resources, and the means was through the common pooling of their meagre resources through the Agency. The Agency was able to work successfully because there were no competing interests amongst the South Pacific countries. They had a common adversary, namely the distant water fishing nations (DWFNs), and therefore it was easy for them to define their interests vis-à-vis the goals of the DWFNs.

Despite these positive developments, cooperative management in the region is still confronted by a number of challenges. These constrain the effective management of the resource and need to be addressed by the South Pacific countries.

Determination of the total allowable catch: The LOSC requires the determination of an allowable catch as an instrument for managing the fisheries resources. While article 61 of the LOSC empowers coastal States to determine an allowable catch, they are constrained by article 64 to cooperate with DWFNs in the establishment of an allowable catch. It has been argued that article 64 requires the establishment of an international organization with broad-based membership to conserve shared stocks and promote their optimum utilization. Article 7 of the UN Fish Stocks Agreement however clarifies that coastal States and DWFNs who fish on the high seas should cooperate to ensure measures adopted for areas under national jurisdiction and high seas are consistent and compatible. The determination of an allowable catch for the highly migratory fish stocks in the South Pacific remains a challenge more so because the countries are so dependent on the resource. The only regional arrangement which has the potential to constrain fishing effort is the *Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery*. The lack of any other framework which could provide the basis for the determination of an allowable catch for the shared stocks poses some problems for the South Pacific countries. An additional layer to the complexity of determining an allowable catch is that other coastal States with important tuna fisheries in the region are not members of the Agency. These are Indonesia and the Philippines. It would not be possible to set a regional total allowable without consideration for the catch in Indonesia and the Philippines.

Problems with development: While as a group the South Pacific countries share a common interest in the conservation and management of the tuna resource, they all have individual national interests to develop the resource which can often clash with their regional interests. With the exception of their dealings with the US in which they act collectively, most dealings with DWFNs have been through bilateral dialogue. While the advantage is that they are able to tailor the outcomes to suit their national interests, DWFNs have been successful in playing one country off against another resulting is dissipated returns in access fees. It is argued that collective bargaining and having a centralized licensing system would strengthen rather than weaken the South Pacific countries negotiating powers and potentially increase revenue from the resource.

Capacity to deal with the challenges: One of the biggest challenges facing the South Pacific countries is the capacity to address the problems identified above. Many of the countries still do not have adequate resources to deal with the problems of science and how to interpret the science for management purposes. While they have collective capacity through the Agency, there are quite obvious inadequacies at the national level. Enforcement, particularly investigative skills in detecting and investigating violations is still not sufficient. Although the Agency conducts in-country prosecution and dockside boarding and investigation training, considerably more support is required before the South Pacific countries are able to undertake comprehensive physical enforcement of their fisheries laws.

LESSONS FROM COOPERATIVE MANAGEMENT OF SHARED FISH STOCKS IN THE SOUTH PACIFIC

Cooperative management of shared fish stocks in the South Pacific provides an interesting backdrop for any analysis of regional fisheries cooperation because the countries involved are so diverse with varying degrees of dependency on the shared fish stocks. On one extreme are the Small Island developing States (SIDS), resource poor and heavily dependent on aid and are overwhelmingly dependent on the resource. On the other, are the DWFNs who are amongst the richest and most powerful in the world. Against such a background it would not be difficult to envisage that the objectives of the two groups would be diametrically opposed to each other. The success of cooperative management in the South Pacific may be attributed to the following factors:

- The South Pacific countries all share a common interest and objective for the conservation and management of shared fish stocks;
- The objectives of the South Pacific countries are explicit;
- The object and purpose of establishing an organization was to assist South Pacific countries deal with their lack of resources in dealing with DWFNs;
- The strong links between the Agency and the Pacific Islands Forum ensured fisheries problems received the highest political consideration;
- Member countries had a clear role in providing policy and administrative guidance in the work program of the Agency;

- The flexible role and functions of the Agency enabled it to respond to different management challenges in a timely and effective manner; and
- The clear delineation between the functions of the technical Secretariat and the governing council of the Agency enabled it to operate effectively as an organization.

The experiences of the Agency and the instruments it has spawned over the past 23 years clearly show that it could not have been achieved with a broadly based organization. Having a clearly defined mandate and a membership that is united by a common purpose is obviously one of the ingredients for the success of the Agency, and cooperative management of shared stocks in the South Pacific. It could not have been done otherwise than through an organization with limited membership, and with the constitutional structure that the Agency has under its Convention.

CONCLUSION

Cooperative management of shared fish stocks in the South Pacific can be broadly categorized into three phases. The first phase, from 1979–1988, can be characterized as a period of consolidation and growth. This was a period during which the Agency was established, not without controversy, because there were countries which wanted to join the Agency that did not recognize the sovereign rights of coastal States over highly migratory fish stocks. Cooperative management during the first phase was also characterized by two levels of cooperation – internal and external. Internally, South Pacific countries had to make adjustments to their fisheries relationship as it became more formal and institutionally administered. They also had to commence negotiations of their maritime boundaries both internal boundaries such as the territorial seas, and archipelagic waters and EEZ boundaries. This was important for fisheries management. Externally, the South Pacific countries through the Agency had to quickly establish rules that would bring the tuna fishery under control since, until the establishment of the EEZ most of the vessels targeting shared stocks in the region had been fishing under the principle of freedom of fishing. This was the period during which the Harmonized Minimum Terms and Conditions of Access for Foreign Fishing Vessels, Regional Register of Foreign Fishing Vessels and the *Treaty on Fisheries between the Governments of certain Pacific Island States and the Government of the United States* were developed.

The second phase of the Agency, the period from 1989–1995, can be characterized as the period of management growth. During this period, the Agency had to respond to a number of management problems that occurred in the fishery. The first was the emergence of the driftnet fishery in the region and the use of long driftnets, which threatened the development of the local Longline tuna industries which were only just being established by some South Pacific countries. The response of the South Pacific countries was both global and regional. At the global level, South Pacific countries sponsored a resolution through the United Nations General Assembly (UNGA) calling for the cessation of the use of long driftnets. Their regional response was the conclusion in 1989 of the *Convention for the Prohibition of the Use of Long Driftnets in the South Pacific*. The Driftnet Fishing Convention prohibits the use of long driftnets. Another problem addressed during that period was the difficulties of enforcement, and the need to share whatever physical resources were available for fisheries enforcement amongst the countries. A framework agreement was thus concluded known as the *Nine Treaty on Cooperation in Surveillance and Fisheries Law Enforcement in the South Pacific*, which allowed two or more Parties to agree to authorize a Patrol vessel and crew from State A to enforce the fisheries laws of State B in State B's EEZ. The increase in fishing capacity in the purse seine fishery in the late 1980s saw the development of two subregional instruments discussed in the paper. These were the *Polou Arrangement for the Management of the Western Pacific Purse Seine Fishery*, and the *Federated States of Micronesia Arrangement for Regional Fisheries Access*. The response of the Agency, however, was *ad hoc* and reactive rather than prescriptive and determinative.

The Third phase, from 1996 – to the present time has been a period of reform. The Agency has attempted to bring its management initiatives in line with the principles of international law found in the 1995 UN Fish Stocks Agreement and the FAO Code of Conduct for Responsible Fisheries. An additional layer to the work of the Agency is the establishment of the new Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific following the conclusion in September 2000 of the *Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean*. The Agency however continues to function very much in the manner for which it was established; coordinating positions and promoting close cooperation amongst its members. In the

context of the new management paradigm in the region, its role and responsibilities will become more important and relevant to the Small Island States of the South Pacific.

MANAGEMENT OF A STRADDLING FISH STOCK: THE CASE OF THE NORWEGIAN SPRING-SPAWNING HERRING FISHERY

by

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I. INTRODUCTION

The Norwegian spring-spawning herring (*Clupea harengus*) stock is the most abundant fish species in the North Atlantic (Bjørndal *et al.*, 1998). The fishery is important for employment and revenue in many countries particularly Norway, which records the largest annual harvest. Other nations, Iceland, Russia, Faroe Islands and some member countries of the EU, also harvest this important fish stock. The introduction in the early 1960s of new fish harvesting technology as well as new fish finding equipment increased the efficiency and ability of the different national fleets to harvest the herring stock. The technological advancements in harvesting and finding fish combined with open access management for both coastal states and the high seas fishery allowed for substantial increases in catch levels and resulted in a collapse of the stock of spring-spawning herring by the end of the 1960s. A fishing moratorium was imposed in 1970 for the purpose of restoring the spring-spawning stock. However, it took more than 20 years for the stock to reach the Minimum Biological Acceptable Level (MBL) and only in the 1990's has the stock reached a point where Total Allowable Catch (TAC) levels can be increased.

The Norwegian spring-spawning herring fishery represents a serious challenge for international fisheries management if the consequences of open access are to be avoided. The task is made more complicated by the migratory behaviour of the species. If the stock of fish is abundant, an international migratory cycle is maintained that extends from Norwegian coastal waters, to international waters of the North Atlantic and to the Exclusive Economic Zones (EEZs) of the EU, the Faroe Islands and Iceland. While the stock is in an EEZ the authority for fisheries management lies with the individual country. On the high seas, the stock is open for harvesting by many fishing nations. If the stock is in a depleted state, as it was in the late 1960s, migratory pressures are removed and the species remains solely in Norwegian coastal waters and under Norwegian fisheries management jurisdiction. Consequently, Norway has a pivotal role in deciding fisheries management policies for the spring-spawning stock. By keeping the stock in a non-migratory state, it is possible for Norway to maintain sole jurisdiction over the fishery. The benefits, however, in terms of revenue, employment, etc. from such a restrictive policy may be small compared to what could be achieved with an abundant migratory fish stock under co-operative international fisheries management.

The purpose of this paper is to evaluate the consequences of alternative management strategies for the Norwegian spring-spawning herring fishery in light of the straddling nature of the stock. The harvesting strategy for three national fleets that fish the Norwegian spring-spawning herring, Norway, Iceland and the European Union, are considered. The fleets are differentiated by cost and harvest efficiency. For each

management alternative evaluated, the consequences for both the biomass and the net profitability of the different fleets are simulated.

Five alternative fisheries management strategies are evaluated. Open access is the base case showing the cycle of stock collapse and eventual recovery. The second case is defined by imposing a simple regulatory scheme of complete fishery closure on the open access case as the stock reaches critically low levels. Third, the stock is restricted to a depleted non-migratory state, remaining only in Norwegian waters and solely under Norwegian fishery jurisdiction. The fourth case investigates the consequences of monopoly control for Norway over an abundant migratory fish stock. In this case, side payments (rather than catch levels) are allocated to other states allowing Norway to maintain monopoly control. The last case (cartel) allows for an abundant migratory fish stock under international fisheries management, where each participating state receives a share of the total catch.

II. THE NORWEGIAN SPRING-SPAWNING HERRING FISHERY

In the 1950's and the 1960s, Norwegian spring-spawning herring (*Clupea harengus*) was a major commercial species, harvested by vessels from Norway, Iceland, Faroe Islands, the former Soviet Union and several European nations. During this period, the fishable component of the Norwegian spring-spawning herring stock is believed to have measured about 10 million metric tonnes. However, during this period the stock was subjected to heavy exploitation by several European nations especially Norway, Iceland and the former Soviet Union, employing new and substantially more effective fishing technology. The annual harvest peaked at 2 million metric tonnes in 1966. By this time, however, the stock was in serious decline and a complete stock collapse occurred by the end of the decade. Finally, with catch levels declining to practically nothing, in 1970, a fishing moratorium was declared.

The migratory pattern and number of components to the stock changed between 1950 and 1970. In the 1950's and early 1960s, adults would spawn off the south-central coast of western Norway (near Møre) from February through March. The adults would migrate west and south-west through international waters toward Iceland (April and May), spending the summer (June through August) in an area north of Iceland. In September the adults would migrate south to a wintering area east of Iceland before returning to western Norway to spawn. Juveniles, including the recently spawned or "zero cohort" would migrate north, but remain in Norwegian waters until sexually mature, around age four or five, when they would join the adult migratory pattern.

In the mid-1960's, a second, more northerly stock component appeared. This component would spawn south of the Lofoten Islands (north of More) with the adults migrating north-west into the north Norwegian Sea, then north-east into the Barents Sea, and finally south to wintering grounds west of the Lofoten Islands before moving south to spawn. By 1966 the northern component was the largest of the two major herring stocks. Because of over fishing and poor recruitment, the spawning biomass of both components fell precipitously in 1968 and 1969, leading to near extinction by 1972. In its depleted state, the adult population ceased migration and both adults and juveniles remained in Norwegian waters year round.

Recruitment remained weak throughout the 1970's and it was not until the strong year class of 1983 joined the adult population in 1986 that the stock began to recover. The main component of the stock has re-established itself on the spawning grounds off More. Now, after spawning, the adult herring begin a westerly migration passing through the EEZs of the EU, Faroe Islands, Iceland and through international waters called the "Ocean Loop" on their way to the summer feeding area near Jan Mayen Island. In the 1990's, the herring have followed the southern edge of the cold East Iceland stream, north and north-easterly, to winter in the fjords of northern Norway.

The migration pattern of the Norwegian spring-spawning herring takes on importance since, as a straddling stock the herring are exposed to territorial and possibly distant water fleets with strong incentives to harvest the population before it moves elsewhere (Bjorndal *et al.*, 1998). If a co-operative management policy, with an equitable distribution of harvest, cannot be agreed upon, Norway, Iceland, Faroe Islands, countries of the EU, Russia and possibly distant water vessels fishing in the Ocean Loop, may resort to 'strategic over fishing' that could jeopardise continued recovery of the stock.

Until recently the situation was quite chaotic. There was no comprehensive regional agreement about the utilisation of the stock. It followed that Norway, Russia, Iceland and Faroe Islands were able to harvest the stock at will within their own jurisdictions. Moreover, in international waters the stock could be harvested legally by any interested fishing nation.

In 1995, the Advisory Committee on Fishery Management (ACFM) recommended a total allowable catch (TAC) for the Norwegian spring spawning herring of 513 000 METRIC TONNES. However, Norway announced an individual TAC of 650 000 metric tonnes of which 100 000 metric tonnes would be allocated to Russian vessels. Iceland and Faroe Islands followed suit and announced their own combined TAC of 250 000 metric tonnes. In total, the collective harvest of Norway, Russia, Iceland, Faroe Island and the EU was approximately 902 000 metric tonnes of herring, almost twice the quantity recommended by ACFM (Bjørndal *et al.*, 1998). Nevertheless, in spite of these high catch levels, the herring spawning stock continued to increase.

There was, however, some progress towards co-operation. In 1996, Norway, Russia, Iceland and Faroe Islands reached an agreement for a combined TAC. The agreement was reached by increasing the quota levels for each country and setting a total maximum limit of 1 267 000 metric tonnes. Nevertheless, the European Union did not take part in a TAC commitment and continued fishing at near capacity. In 1997, the EU became a signatory to an agreement limiting the maximum total catch to 1 498 000 metric tonnes. The significance of this agreement is that the EU in a commitment to international fisheries co-operation agreed to reduce their total catch levels from the previous period, whereas, the four other member countries again increased individual TACs (Bjørndal *et al.*, 1998). Notwithstanding, the stock of spring-spawning herring showed great robustness and continued to increase.

The countries involved agreed to continue co-operation and in 1998 the total TAC was somewhat lower than 1997 at 1,3 million metric tonnes. The new quotas for 1998 are distributed such that each country receives approximately 13 percent less share than for 1997. There are also bilateral arrangements that allow harvesting in the EEZ of other member countries. For example, for fishing spring-spawning herring Russia, the EU, Iceland and Faroe Islands are all granted limited access to Norwegian fishing waters and vice versa. For 1999, the TAC was 1.3 million metric tonnes, for 2000 1.25 million metric tonnes, and for 2001 0.85 million metric tonnes.

In an international context, the intergovernmental UN Conference on Highly Migratory and Straddling Stocks (1993-1995) dealt with the management of fishery resources found both within the EEZs of coastal states and the adjacent high seas. A number of suggestions had been proposed to solve the contradictions between the rights and duties of the coastal states and the distant water fishing nations. A consensus was arrived at that the management of straddling and highly migratory fish stocks is to be carried out through regional fisheries management organisations. The members in a regional fishery organisation are coastal states and distant water fishing nations with a "real" interest in the fishery.

The international waters in the Norwegian Sea (the Ocean Loophole) is an important example of the problems addressed by the UN Conference. A number of suggestions had been proposed to solve the contradictions between the rights and duties of the coastal states and the distant water fishing nations. A consensus was arrived at, namely that the management of this stock should be based on a "two pillar" system. By this is meant that the coastal states, which constitute one pillar, agree on the management of the part of the stock that falls within their EEZs, and the Regional Fisheries Management Organisation, which for the Norwegian spring-spawning herring means the North East Atlantic Fishery Commission (NEAFC), constitutes the other pillar, providing for management of the part of the stock that is in international waters.

The recovery of the Norwegian spring-spawning stock offers the opportunity for substantial annual harvests on a sustainable basis for the benefit of all nations involved. It is clear that if the current co-operative arrangement among the countries fails and there is a return to the open access conditions of the early 1990s, this will result in increased international competition for harvest shares that will be biologically, economically and politically damaging. Eventually, this could threaten a new stock collapse for the fishery and result in substantial economic damage for all nations concerned in terms of lost revenue and employment as catch levels decline.

III. A BIO-ECONOMIC MULTI-AGENT SIMULATION MODEL

We assume that the characteristics of the international spring-spawning herring fishery can be captured in a three-agent model. The agents are defined based loosely on historical coalitions in the fishery. Norway and Russia have shown co-operation in respect to resource management and setting of quotas, and we treat these two countries as one economic agent referring to the coalition as Norway. Similarly, Iceland and Faroe Islands have co-operated in setting catch levels. As well, for these two countries the fishing grounds overlap and the harvest technology employed is similar. We will thus treat Iceland and Faroe Islands as one agent called Iceland. Several European countries, all of whom are members of the European Union (EU), also participate in the fishery using similar technology. Therefore, we will consider the EU as the third agent in the fishery.

In Norway, three different harvest technologies are employed (coastal vessel, trawler and purse seine) in the spring-spawning herring fishery (Bjorndal and Gordon, 1998). Cost of harvesting and quality of catch depends on the technology employed. However, in terms of quantity landed and harvest efficiency, purse seine is the most important vessel type. For this reason, the specification of the cost function for the Norwegian fleet used in simulation is based on the purse seine technology. As well, for consistency, the harvest cost functions for Iceland and the EU are also based on the purse seine technology. Regardless of the similar technology used in the fishery, the cost of harvesting may still vary across the national fleets. This is because even if the underlying technology is the same, certain aspects of the technology such as boat and engine size may still vary, and input prices for factors of production may be different. Moreover, individual boat quotas may vary from country to country. Even more importantly, the distance to the fishing grounds will be systematically different for the three economic agents. Based on this specification, Norway is assumed to be the most efficient harvester, followed by Iceland and then the EU.

IV. MANAGEMENT STRATEGIES FOR THE FISHERY

Five strategies are evaluated for managing the spring-spawning herring fishery. We evaluate a broad range of managerial behaviour from the competitive open access to international co-operative arrangements in managing the fishery. One important and robust result of the simulation work is that the competitive open access fishery provides lower net returns and maintains lower stock levels compared to any of the co-operative solutions investigated. However, given that for this international fishery open access has historically been the prime management tool of choice, we define this as the base case in which to compare more co-operative outcomes.

In the open access case, no restriction is placed on the harvesting strategies of the agents defined in the simulation model. We assume the objective of each fleet is to engage in harvesting for the purpose of maximising rent. In a competitive open access fishery, each fleet will continue to extend its fishing effort as long as total cost is less than total revenue. Fishing effort extended by individual fleets is measured by a fishing mortality index and is a function of harvest efficiency. (A fishing mortality index of 1.0, 0.9 and 0.6 is maintained for Norway, Iceland and the EU, respectively.) In an open access profit maximising environment, the fleets will have incentive to continue harvesting until profit or rent has been dissipated, i.e., the classical tragedy of the commons. The simulations showing harvest levels, fishing mortality, spawning stock biomass and net profitability are carried out over a 70 year period. Figure 1a, shows the harvest level for each of the three fleets and the total or aggregate harvest for the international fishery. Corresponding overtime to harvest levels, Figure 1b, 1c, and 1d graph out fishing mortality, spawning stock biomass and net present value of returns, respectively.

The simulations are based on an initial spawning stock biomass taken from mean data for catch, abundance and maturity for the actual stock of herring for the period 1993-1996. From Figure 1a and 1b, for the first few years harvest levels and fishing mortality increase and all three fleets show similar catch levels and rising profit levels. As harvesting continues the spawning stock biomass declines and this is reflected in decreased catch levels. Declining yields, however, do not diminish fishing effort because revenue continues to exceed total cost and fishing effort increases. Figure 1b shows that for all fleets total fishing effort is achieved after the initial five years of harvesting. It is worth pointing out that each fleet maintains its maximum fishing effort over the next 12 to 15-year period regardless of the declining stock biomass and

catch levels. What is more, fishing effort only starts to decline after the stock biomass falls far below the safe biological level (SSB in Figure 1c) and approaches near collapse.

The reason for this excessive fishing effort in the face of serious stock decline is that in a competitive open access environment restraint on fishing effort by one fleet will only mean that another fleet will harvest the catch and, therefore, each fleet has incentive to continue fishing. This is the basic problem of the commons and is a result of the lack of well-defined property rights over the stock of fish.

Based on the economic and biological parameters of the spring-spawning herring fishery, the simulation model predicts that harvesting will continue with ever-declining catch levels until the stock collapses. After the collapse, the population dynamics (Figure 1c) shows that about 20 years are required for the stock to enter a recovery phase. A complete stock recovery even to the average 1993-1996 levels is not possible because in the open access case a positive stock response immediately initiates harvesting and the cycle, albeit at a much lower amplitude, repeats. It is interesting that in the stock recovery phase only Norway and Iceland find it profitable to expend total fishing effort to harvest. The EU shows only moderate fishing effort and fishing mortality. In Figure 1d, net profitability mirrors closely the fortunes of catch levels increasing only during the initial phase of harvesting and, thereafter, declining continuously until the stock is depleted and net profits fall to zero.

For the spring-spawning herring fishery open access competitive harvesting is inadequate to maintain a healthy biological stock and, clearly, the long-term economic benefits are minimal. However, it is interesting that within an open access regime the simple management strategy of complete fishery closure as the stock falls below the safe biological level (SSB) has substantial positive consequences for both stock and profit levels.

In Figures 2a - 2d, we show simulation results for harvest levels, fishing mortality, spawning stock biomass and net profitability, respectively, for open access harvesting with a management strategy of fishery closure. There are a number of interesting changes to the open access outcomes resulting from this simple management practise. The figures show four cycles of the simulation for this management regime. The initial cycle mirrors that of the open access until the stock decline reaches the safe biological level and closure is imposed. At this time catch levels and profits are set to zero. However, because closure is enforced prior to stock collapse and more fish are alive to spawn recovery occurs more rapidly compared to open access. Note that in Figure 2c, stock levels fall somewhat below the safe biological level, which reflects time required by the fleets to reduce fishing effort to zero. With stock recover in the second phase of the cycle harvesting resumes and profit taking occurs. The length of time with zero catch and zero profit levels is substantially reduced compared to the open access position. During the second phase, stock recovery is substantial and we observe increases in biomass two times greater than the average stock levels for the 1993-99 period. This is an important prediction from the simulation model and shows that a simple co-operative outcome of adhering to fishery closure allows for significant increases in stock size and catch levels over the simulation period. In the recovery period, Figure 2d shows an increase in profits earned especially for Norway and Iceland compared to open access. Profits appear lower in the third and forth phase of the cycle compared to the previous cycle due to discounting.

Open access with fishery closure shows great improvement in stock and profit levels over the unfettered open access regime, but it does require international co-operation in following the order for fishery closure. Norway as the pivotal and efficient harvester in the international fishery could exclude all other parties from fishing spring-spawning herring by maintaining the stock at below migratory levels and thus corralling the stock in Norwegian waters. It is estimated that a spawning stock biomass below 500 thousand tonnes will trigger non-migratory conditions. For Norway the important question is whether such a restrictive stock policy would provide sufficient benefits to make the effort worthwhile.

In Figures 3a-3d, the harvest level, fishing mortality, spawning stock biomass and net profit are shown for a 70-year simulation period for a non-migratory fish stock. The simulation period is identical with other management schemes. The economic objective characterising the harvesting process is not the simple open access behaviour of harvest as long as revenue exceeds cost, rather it is a combined objective of maximising profits and maintaining a non-migratory fish stock.

The harvesting strategy is to engage in full fishing effort (i.e., fishing mortality equal to one) increasing harvest yields and most importantly forcing the stock of fish to a non-migratory biological level. (This period of the simulation is identical to open access and, of course other economic agents are harvesting and earning profits.) After this point, the objective is to harvest at a monopoly profit maximising position subject to biological control on the level of the stock. The control allows fishing effort to reach maximum levels (i.e., fishing mortality set to one) as stocks increase and to then rapidly curtail fishing effort (i.e., fishing mortality set to 0.5) as stocks decline. By controlling fishing effort in an on/off manner, harvest and stock levels are maintained in a low amplitude cycle over time.

There are a number of advantages and disadvantages to Norway from a non-migratory management scheme. On the one hand, catch levels never fall to zero and thus there is continuous uninterrupted employment, albeit at a low level, for the Norwegian fishery. At the same time, profit levels although reduced are maintained at above zero levels. On the other hand, as shown in Figure 3d, profit levels are not substantial and net present value declines overtime (because of discounting) monotonously towards zero. Moreover, a policy of maintaining low stock levels adds another dimension of difficulty and uncertainty to the management problem in increasing the risk of complete stock collapse due to random biological occurrences. If a Norwegian objective for the fishery is to maximise the economic benefits to Norwegians, a non-migratory management scheme appears to fall far short of the benefits expected from such a potentially important resource.

One obvious result of the three management schemes evaluated thus far is that international co-operation enhances the stock level and, perhaps more importantly, the economic benefits to all parties to the fishery. We explore further the possibilities for international co-operation by investigating the consequences of using side-payments to maintain a single fleet monopoly position over an abundant migratory fish stock, and of a co-operative cartel agreement to share a total catch quota for the fishery. The two co-operative schemes are similar in that the monopoly case allocates shares of the total rent, whereas, the cartel case allocates shares of the total catch. However, the economic difference in terms of potential profit is substantial.

The monopoly case is of special interest because it allows measurement of the total potential profits that could be generated in the fishery by harvesting the stock at the most efficient level. In simulations, Norway is defined as the low-cost efficient harvester. The harvest level for the monopolist is based on a constant fishing effort/mortality rate consistent with maximising monopoly profits. It is interesting, and in anticipation of the results, that we measure total net profits generated in the monopoly case as sufficient to more than compensate the non-participating fleets at a level greater than their best opportunity in the fishery and thus making such a management scheme economically viable.

Figures 4a-4d show monopoly harvest, profit vs. fishing mortality, spawning stock biomass, and net profits, respectively. The simulations show that the monopoly output is substantially different relative to the previous management cases examined. In contrast to open access, initially both the harvest level and spawning stock biomass decline rapidly. This is caused by the monopolist setting a fishing effort at a level consist with monopoly profit maximisation. The stock of fish eventually reaches a minimum point and increases due to strong year classes entering maturity stages. The stock is allowed to increase over time because fishing mortality does not respond to the stock of fish but only to profit maximisation. As this occurs, the harvest increases steadily and eventually reaches an equilibrium position. Nominal profits respond to harvest levels, showing an initial decline and then increasing to a stable level. Of course, with discounting, Figures 4d shows nominal profit stability as a general decline in net profitability. Overtime, the spawning stock biomass reaches equilibrium at about 6.5 million tonnes within the monopoly profit maximising environment. This is not large compared to stock levels achieved in, say, open access with fishery closure, rather, it is the stability of the equilibrium overtime that distinguishes the stock effect of the monopolist from other cases investigated.

To capture the profit potential of the monopoly position requires a total commitment to international co-operation in the fishery, in terms of agreeing to share the total rent rather than share the total catch. An alternative strategy is to allocate a share of the monopoly harvest to each of the individual fleets. This allows all fleets to participate in the fishery but because the different fleets are characterised by different levels of harvest/cost efficiency, there will be a general loss in total profits earned in the fishery. The loss in potential profit between monopolist and cartel control of the fishery can be measured from the simulations.

Based on historical harvest levels Norway will receive the largest share (51 percent), then Iceland (29 percent) and the EU (20 percent). Once shares are allocated, each fleet will operate in an efficient profit maximising manner. In other words, each fleet will set a fishing effort/mortality rate to maximise profits over individual shares. This behaviour is analogous to that of the monopolist in terms of total harvest and spawning stock biomass for the fishery. Of course, the harvest and profit levels are shared among the three fleets.

In Figure 5a, the harvest level is reported for Norway, Iceland and the EU, respectively. Whereas, the corresponding profit levels for individual fleets are reported in Figure 5b. With fishing effort/mortality rate set by profit maximisation, harvest levels first decline and then rise to an equilibrium level overtime for the same reason as under monopoly behaviour. Similarly, net profits for the three fleets show that Norway earns a substantial rent based on its cost efficient harvesting levels compared to Iceland and the EU. Finally, in Figure 6, we draft out the total net profit for the monopolist position and correspondingly the cartel position. The monopolist earns the greater return over all periods. The differences in profit level at each point in time reflect the different efficiency levels across the different fleets. The interesting question is whether sufficient additional profit is earned under the monopolist position to compensate the other players to allow the monopoly position to exist?

We address this question in Table 4 where net profit levels across the five alternative management strategies are listed. Keep in mind that nominal profit is discounted at 4 percent annually over a 70-year time horizon. First, comparing open access management to open access with fishery closure, all three agents are made better off in terms of higher net profits by engaging in co-operation and adhering to fishery closures. However, it is also clear that the benefits of co-operation are not equally shared across the different fleets. Norway sees an increase of 149 percent, Iceland an increase of 106 percent but the EU measures only an increase of 43 percent relative to open access. Both Norway and Iceland clearly benefit from co-operation in the fishery, whereas co-operation for the EU is somewhat less advantageous. Nonetheless, there is ample profits earned in the fishery between Norway and Iceland to offer side payments to make it worth while for the EU to adhere to fishery closure. The alternative would be a return to open access where both Norway and Iceland would be worse off.

Second, we measure the overall net profitability of sole Norwegian jurisdiction over a non-migratory fish stock. In this case, Norway maintains complete fisheries control over the herring stock and achieves an increase in profitability of 61 percent over what could be obtained under unrestricted open access. The net benefit in excess of open access is achieved because of Norway's substantial share of the initial abundant stock prior to stock collapse. In other words, Norway achieves substantial profits prior to stock collapse and non-migratory behaviour. Measuring benefits to Norway only after the stock reaches a non-migratory level shows this management position comparatively worse-off than the unrestricted open access position. A net present value of profit of 4.79 billion NKr. in the non-migratory case compared to 5.49 billion NKr. for open access. Nevertheless, even if the benefits of a non-migratory scheme include the initial abundant stock, Norway suffers a 65 percent decline in profit compared to open access with fishery closure. The consequences of a non-migratory herring fisheries policy can be costly to Norway in terms of lost profits. On the other hand, benefits from international co-operation with an abundant migratory fish stock can be substantial in harvest levels and net profitability.

The last scenario is to compare net profitability of the monopoly position with that of the cartel. In the cartel case, the simulation results are based on allocating harvest shares on historical catch levels for the three fleets. Table 4 shows that Norway would benefit substantially from this historical allocation showing an increase of 41 percent in net profits compared to open access with fishery closure. On the other hand, both Iceland and the EU see their net profits increase by 3 percent and 2 percent, respectively compared to open access with fishery closure. Because total profits under cartel arrangements are 25 percent higher than under open access with fishery closure, a different allocation of catch shares could be negotiated that would allow both Iceland and the EU to receive a larger share of total profit. The important question, however, is whether under monopoly harvesting in the international fishery could Iceland and the EU be sufficiently compensated to support such a position? That is, Iceland and the EU would become non-participants in the fishery but receive a share of the total rent. The simulations show that allowing for efficient cost of harvesting net profits

are 28 pereent higher under a monopoly eompared to cartel. In other words, by international agreement to share the total rent from the fishery rather than total eateh all members to the fishery can be made better off.

V. CONCLUSION

The purpose of this paper is to analyse and compare the consequences for stock levels and net profit potential of alternative management strategies for the international spring-spawning herring fishery. Five alternative management schemes are evaluated. Open aceess is the base ease showing the cycle of stock collapse and reeovery. The second case is defined by imposing a simple regulatory scheme of complete fishery elosure on the open aceess ease as the stock reaches critieally low levels. Third, the stock is restrieted to a depleted non-migratory state, remaining only in Norwegian waters and solely under Norwegian fishery jurisdietion. The fourth case investigates the eonsequences of sharing among the three agents the rents obtained from monopoly harvesting over an abundant migratory fish stock. The final case allows sharing the total eateh among the three agents for an abundant migratory fish stock under international fisheries management.

Competitive open access shows increased and sustained fishing effort by all fleets while harvest levels decline. Eventually, undiminished harvest results in stock eollapse and demise of the fishery. A management restrietion of fishery elosure on the open aceess as stock falls below safe biologieal levels has substantial positive benefits for both the stock level and potential net profits to all partieipates in the fishery.

Examining the possibilities for Norway to maintain sole fisheries jurisdiction over a small non-migrating stock of herring corralled in Norwegian waters shows minimal benefits in terms of net profits to the Norwegian fishery. Compared to the eompetitive open access fishery with elosure, a non-migratory herring fishery policy leaves Norway much worse off in terms of eeonomie benefits.

Finally, we show that either a monopoly or a cartel position with an abundant migratory fish stock can bring significant benefits to all partieipates in the industry. Under monopoly the largest potential profits are earned in the fishery but international agreement is required to share the rent among the non-partieipates that would allow the monopoly to exist. Under cartel potential profits, although smaller than monopoly, are larger than under open access with fishery closure, but requires international agreement to share the monopoly harvest level. Whether international agreement allocates shares of rent or eateh levels, management eo-operation in the spring-spawning herring fishery can achieve substantial economic benefits for all partieipates to the fishery under sustainable stock levels.

Table 1. Total Discounted Profits

Net Present Value of Profit, 4% diseount rate

Management Regime	Norway	Iceland	EU	Sum
Open Access	5.49[a]	3.89	1.31	10.65
Open Access with Fishery Closure	13.72	8.04	1.88	23.64
Non-Migration	8.85	-	-	8.85
Cartel	19.39	8.26	1.92	29.57
Monopoly	38.04	-	-	38.04

[a] all values are 10 to powcr 9

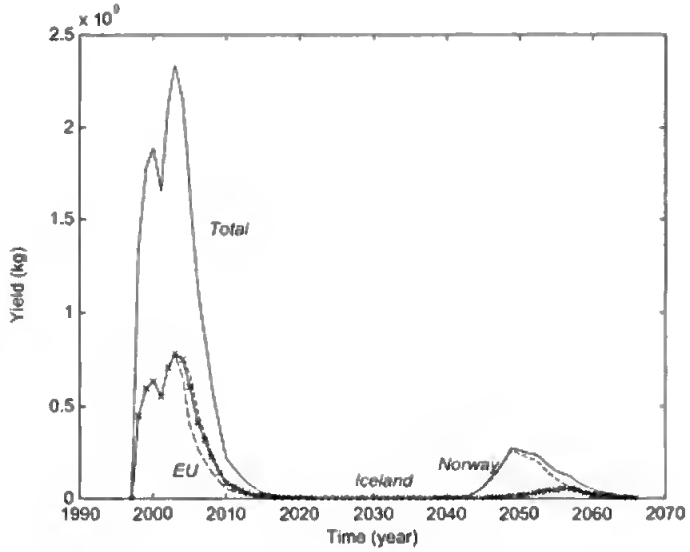


Figure 1a. Harvest Levels, Open Access

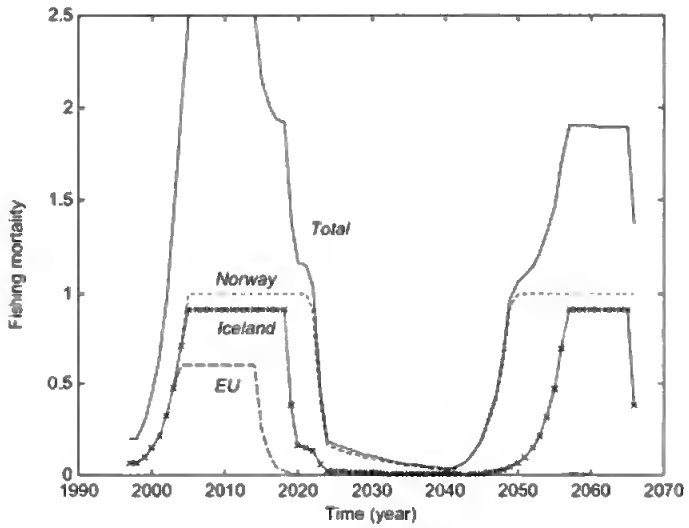


Figure 1b. Fishing Mortality, Open Access

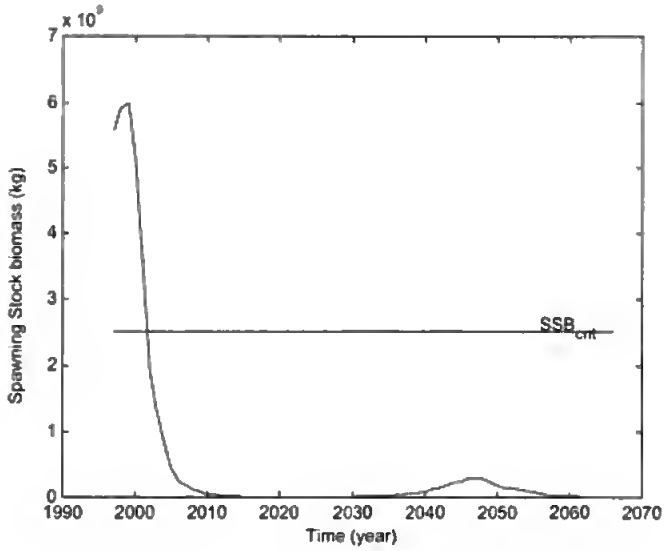


Figure 1c. Spawning Stock Biomass, Open Access

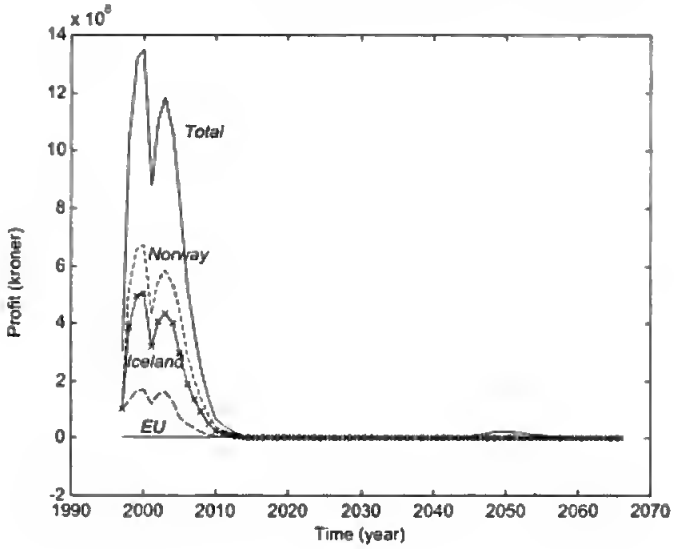


Figure 1d. Profit, net present value, Open Access

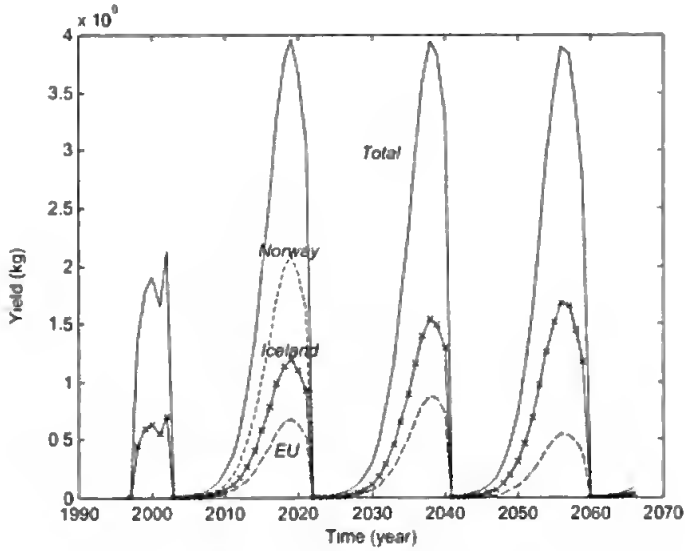


Figure 2a. Harvest Levels, Open Access with Fishery Closure

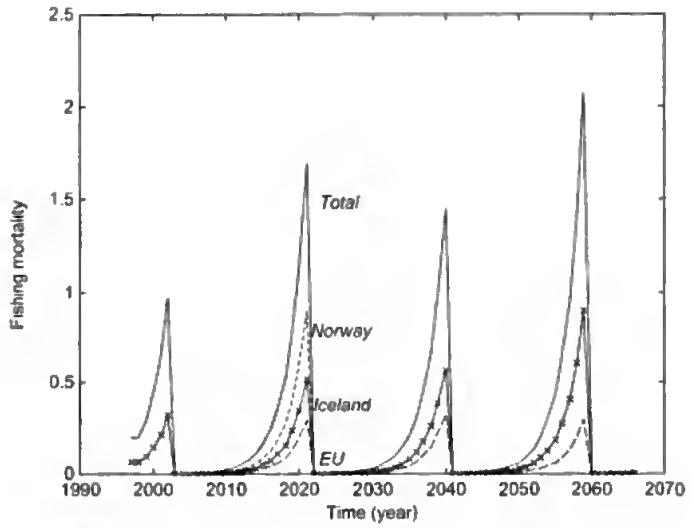


Figure 2b. Fishing Mortality, Open Access with Fishery Closure

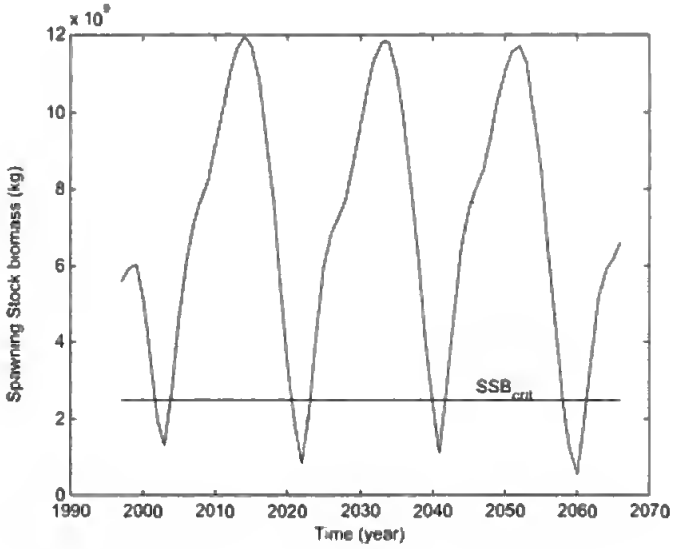


Figure 2c. Spawning Stock Biomass, Open Access with Fishery Closure

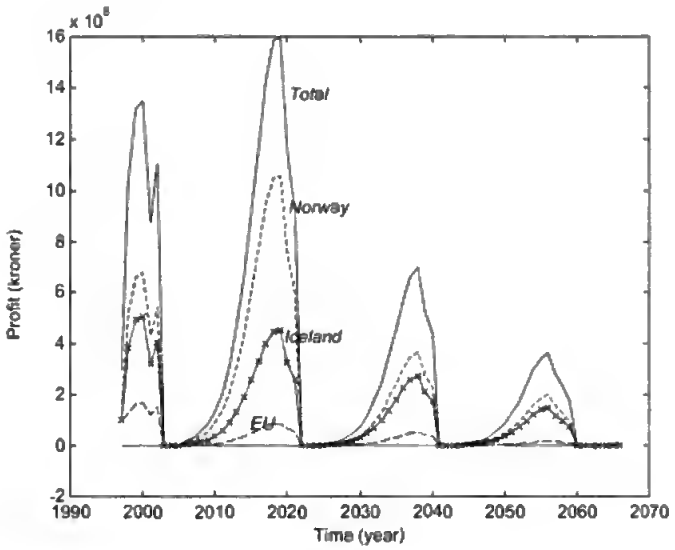


Figure 2d. Profit, net present value, Open Access with Fishery Closure

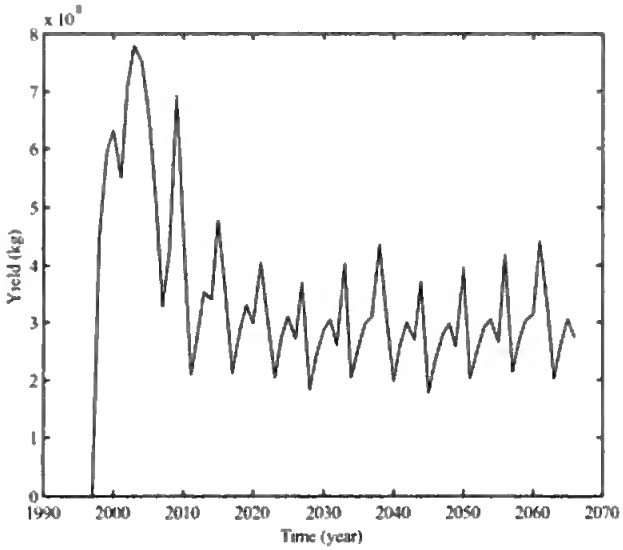


Figure 3a. Harvest Levels, Non-Migration

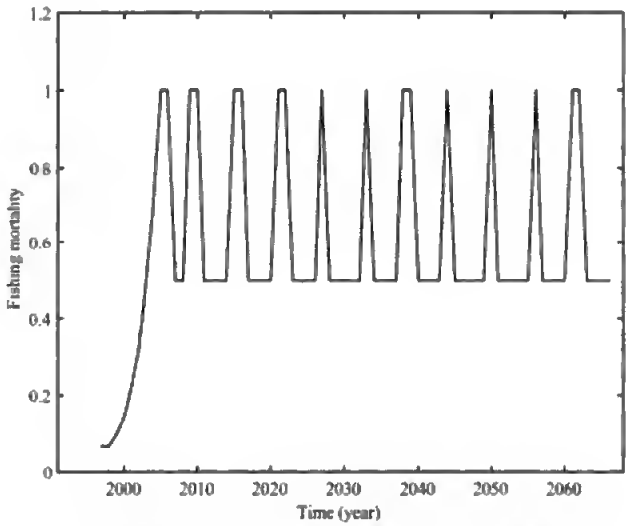


Figure 3b. Fishing Mortality, Non-Migration

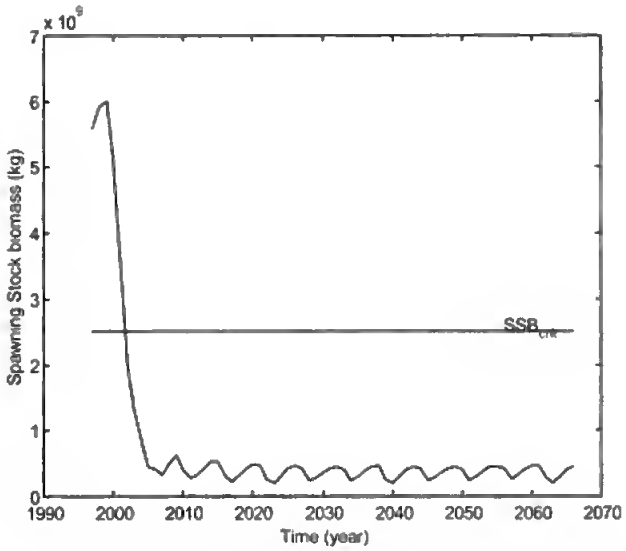


Figure 3c. Spawning Stock Biomass, Non-Migration

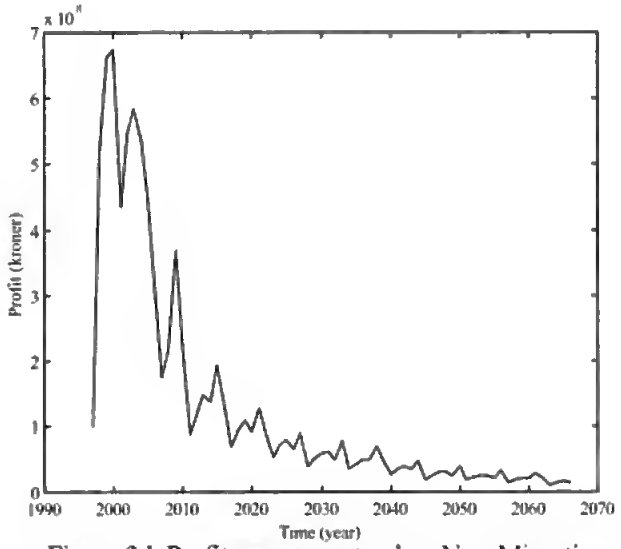


Figure 3d. Profit, net present value, Non-Migration

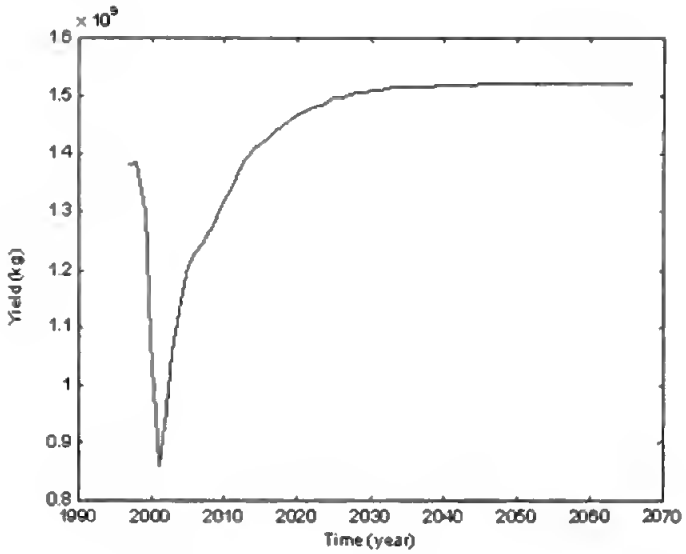


Figure 4a. Monopoly, Harvest

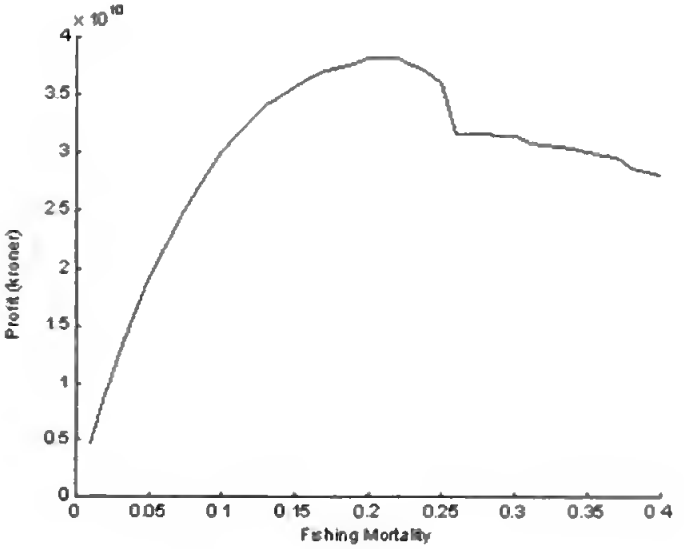


Figure 4b. Monopoly Profit vs Fishing Mortality

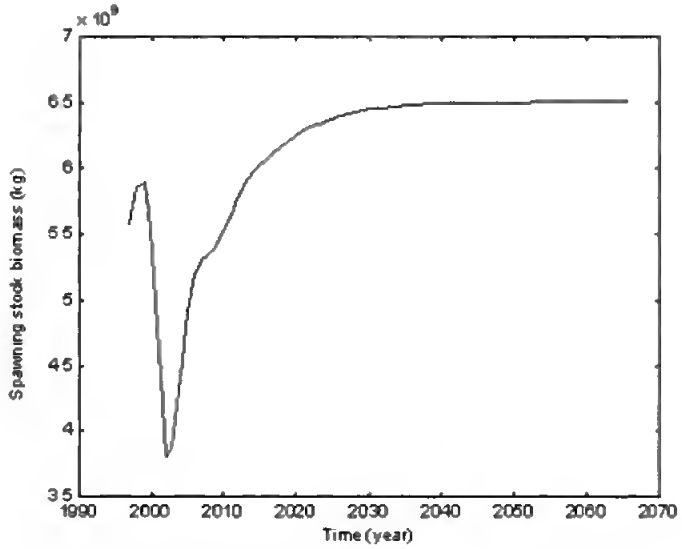


Figure 4c. Monopoly, Spawning Stock Biomass

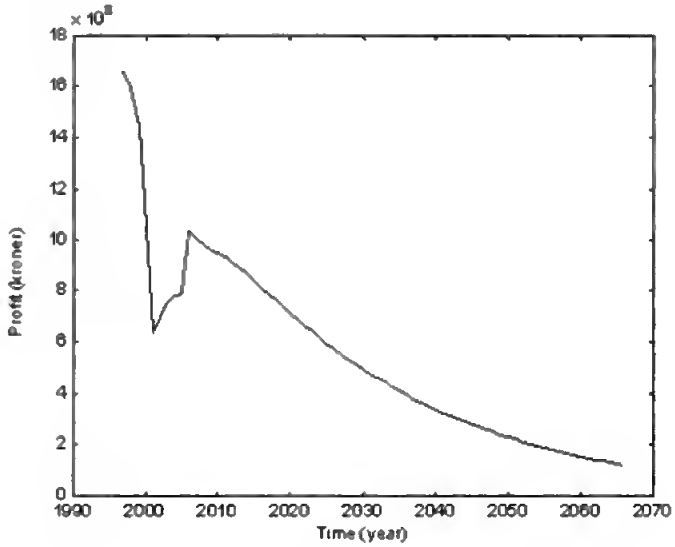


Figure 4d Monopoly, Profit

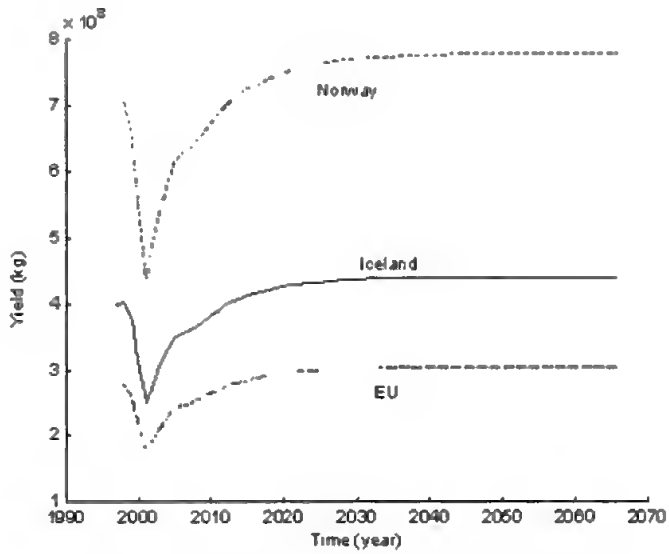
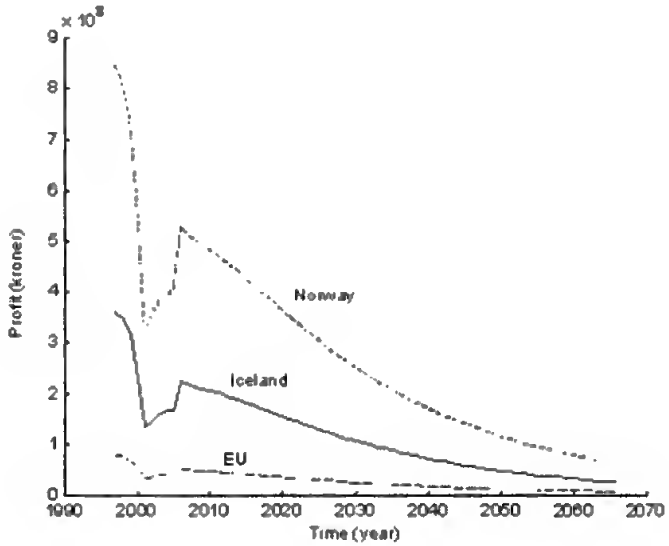


Figure 5a Cartel Harvest



Figures 5b. Cartel Profit

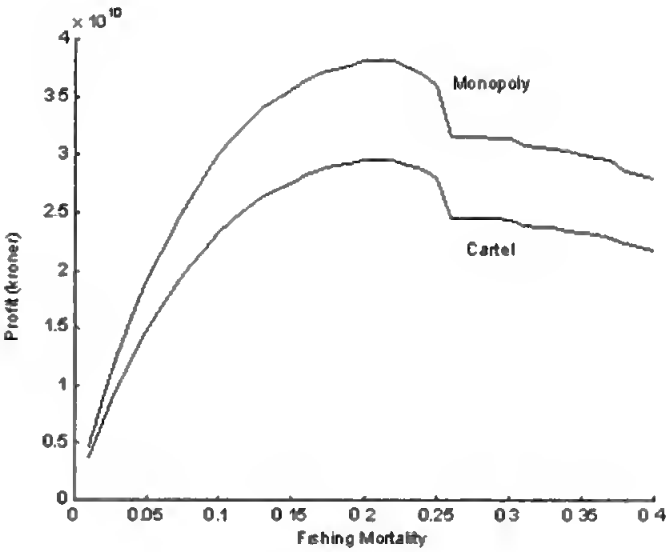


Figure 6. Total Profit, Monopoly vs Cartel

SHARED FISHERY ARGENTINE-URUGUAYAN COMMON FISHING ZONE

by

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SUMMARY

Cooperative management of fisheries shared by Argentina and Uruguay had its origin in the Treaty the two countries signed in November 1973. The Treaty is a legal document based on the cooperation between two neighboring and friendly countries sharing a peaceful history. Two large geographic areas were established: the Rio de la Plata, from its origin till its outside border and from this, the sea itself, a pure marine area named Common Fishing Zone (ZCP).

The fishing fleet from Argentina and Uruguay operate inside the River and in the ZCP, exploiting the species with higher commercial value. Fisheries in the River are managed by the Administrative Commission of the Rio de la Plata (CARP) and the one in the Common Fishing Zone (ZCP) by the Technical Commission of the Maritime Front (COFREMAR). Owing to the situation that there are species distributed over both regions, the Rio de la Plata as well as the ZCP, both Commissions agreed to establish a joint management administration.

This paper presents a description of fisheries, the main species harvested and the rules applied to their management and conservation. The Treaty regulation established to fix the volumes of capture by species and to divide them between the two countries, is mentioned.

Different arguments relating to the application of the Treaty are discussed, chiefly regarding the distribution of captures. A synoptic analysis of the situation of the most important commercial species is presented as well as the regulations that are being applied or programmed for their recovery. The scientific researches activities are presented that are carried out by the two Commissions, through the project concerning the protection of the aquatic environment to avoid contamination and to restore the various habitats.

GENERALITIES

SEQUENCE OF THE EXPOSITION

This paper begins with a description of the legal framework that supports the fisheries shared between Argentina and Uruguay, arising from the Treaty elaborated by the two countries. The requirements asked by FAO will be treated in the following sequence: First, "to describe the nature of fisheries", and includes the essence, the arrangement, the quality and availability of fisheries resources. Second, the requisites asked by FAO concerning critical topics that alters the effectiveness and success of the managements of shared fisheries resources. Finally, the practical problems that arose from the management of shared resources, those that were resolved, those that are being determined, and the conclusions regarding the requirements asked by FAO.

I. LEGAL FRAMEWORK

I.1 **The Treaty.** On 19th November 1973, Argentina and Uruguay signed the Treaty of the Rio de la Plata and its maritime front. If necessary to define in a few words its essence, it could be summarized as a "Cooperation Treaty". One of its objectives consists of giving general rules in order that the two countries are able to carry out their fishing activities.

I.2 **Rio de la Plata.** The first part of the Treaty is dedicated exclusively to the Rio de la Plata and different aspects are considered concerning the legalities, navigation, lightening, protection of human life, rescue, pollution and others. One chapter that explains specifically the rules about fisheries.

I.3 **Outside border of the River.** An imaginary line is observed, extended between the geographic sites of Punta del Este in Uruguay and Punta Rasa, (Cape San Antonio) in Argentina (Figure 1). This line established by the two countries in 1961, constitutes the outside border of the Rio de la Plata as well as the beginning of its Maritime Front.

I.4 **Maritime Front.** The second part of the Treaty refers to the Maritime Front which addresses: the side maritime border, navigation, fishing, pollution, research and defense. The chapter on Fishing includes the agreement to establish a Common Fishing Zone (ZCP) which consists in a large maritime area extending from the borders of the Territorial Sea to the 200 miles (Figure 1).

I.5 **Founding and functions of the bilateral Commissions.**

a) Rio de la Plata (CARP)

The first part of the Treaty includes the disposition to establish the Administrative Commission of the Rio de la Plata (CARP) with different functions. Those concerning fisheries are summarized in the following statements:

1. To promote joint activities on scientific studies and research;
2. To establish rules to control the fisheries activities in the Rio de la Plata, related to the conservation and protection of living resources;

b) Maritime Front (COFREMAR)

The second part of the Treaty resolves the establishment of the Technical Commission of the Maritime Front (COFREMAR) with jurisdiction in the Common Fishing Zone. The different functions concerning to fisheries is detailed in the following statements:

1. To fix the volumes of catches by species, to distribute them between the two Parties and to settle (regulate) the capture periodically;
2. To promote joint activities on scientific studies and research;
3. To formulate recommendations and to apply projects having as a main objective: to ensure the maintenance of the value and equilibrium in the biological systems;
4. To establish rules about the rational exploitation of species and to prevent and eliminate pollution;
5. To arrange plans concerning protection, conservation and development of living resources.

c) Budget of the Commissions, CARP and COFREMAR

The two Commissions receive annual financial support equally shared by the two countries, to cover costs of operation and administration, research surveys and study groups.

II. DESCRIPTION OF THE TYPE OF FISHERIES

II.1 Fisheries in the Rio de la Plata. Species and geographical areas of distribution.

a) Three types of fisheries coexist in the Rio de la Plata: the artisanal, the sports/recreational and the commercial fisheries. The last one is operating in the river and marine waters.
b) The species of higher commercial value are caught in the lower Rio de la Plata.
c) Whitemouth croaker (*Micropogonias furnieri*) occupies the first place. It is a coastal demersal resource inhabiting from the proximities of the coast line, till 20 meters depth (Figure 1). Its main area of reproduction is in the "wedge shaped" zone, from the line formed between Punta Piedras (RA)-Punta Brava (ROU) till the line between Punta Piedras (RA) – Piriápolis (ROU). There are nursery grounds in the proximities of Montevideo, and of Samborombon Bay, and others of less density, along the coasts. Concerning the whole habitat of croaker, 80 percent of its biomass is distributed in the Rio de la Plata and 20 percent in coastal areas of the Common Fishing Zone (ZCP). Total geographical area of distribution exceeds the scope of the Treaty.
d) The second important commercial species is stripped weakfish (*Cynoscion guatucupa*), a coastal demersal resource that inhabits till 50 meters depth. It is more oceanic than whitemouth croaker, with a geographical area of distribution that includes 20 percent in the Rio de la Plata and 80 percent in the Common Fishing Zone (ZCP). The total geographic area of distribution exceeds the scope of the Treaty.
e) Another commercial species is the Patagonian smoothhound (*Mustelus schmitti*), with a nursery ground in the Samborombon Bay, and its habitat is covered from the coast till a maximum depth of 120 meters in the south.
f) Other commercial species inhabiting the Rio de la Plata are: black drum (*Pogonias cromis*); eagle ray (*Myliobatis goodei*), flounder (*Paralichthys orbignyanus*) and king weakfish (*Macrodon ancylodon*).

II.2 Fisheries in the Maritime Front. Jurisdiction, species and areas of distribution

a) The lateral maritime boundary of the above mentioned Common Fisheries Zone [ZCP (2.3.)] delimits the control areas for each country, being a real border except for legally authorized operation of fishing fleets by the two Parties.
b) Hake (*Merluccius hubbsi*), a migratory species, is the most important commercial resource. It has its highest abundance (density) in the ZCP, and appears from middle autumn till October. During summer months, hake migrates to the south extending from 34° S to 41° S latitude, an extension that outlines the northern management unit of this species. On the other hand, there is a southern management unit for the same species that extends from 41° S to 48° S, but this unit has not any relationship with the present work. The associated fauna of hake, includes the following species with less biomass and different patterns of distribution:

Pink cusk-eel (*Genypterus blacodes*)
Hawkfish (*Cheilodactylus bergi*)
Argentine seabass (*Acanthistius brasiliensis*)
Parona leatherjack (*Parona signata*)
Brazilian codling (*Urophysis brasiliensis*)
Red porgy (*Sparus pagrus*)
Argentine squid (*Illex argentinus*)

c) Argentinian Fishing Fleets: Two types of fisheries are in the ZCP, one is the coastal/artisanal fishing fleet which harvests coastal demersal species (white croaker and stripped weakfish) and pelagic species such as anchovy (*Engraulis anchoita*). This fishing fleet is made up of smaller sized vessels, with limited hold capacity. The other fishery is the one of the high seas fleet, which operates in the sea, with large sized vessels that catch hake and its associated fauna. Fishing vessels come from the Argentinian harbours of Mar del Plata, Quequén and Ing. White.

d) Uruguayan Fishing Fleet: Before this present Treaty was signed, Uruguay had an artisan coastal fleet which operated on the coastal resources, chiefly with whitemouth croaker and stripped weakfish. Hake catches were around 1 000 tonnes/year.

Since the ratification of the Treaty, in February 1974, Uruguay developed a high seas fleet with hake as the main target, whose catch has been increasing from then onwards, together with its associated fauna. The fishing vessels come from the Uruguayan harbours of Montevideo, Colonia and La Paloma.

II.3 Generalities concerning the distribution of catches.

a) The Treaty establishes that the volumes of catches for the Rio de la Plata and the ZCP must be as follows:

- -For the Rio de la Plata, volumes must be fixed in agreement and distributed equally between the two countries.
- -For the ZCP, criteria of equity and proportionality are established and applied by the COFREMAR, in order to fix the volumes of catches and allocate them between the two Parties. The proportionality must be evaluated according to the ichtic abundance each Party contributes, based on the scientific and economic criteria.

b) When the Treaty is applied, a particularity arises concerning the determination of volumes of catches and allocation between the two Parties involved, of those species (white croaker, stripped weakfish, and Patagonian smoothhound) which inhabits the Rio de la Plata as well as the Common Fishing Zone. Their biomasses are submitted to different patterns of distribution. The procedure adopted by the two Commissions to fix and distribute the Total Allowable Catch (TAC) and to manage those resources, will be mentioned in due course.

II.4 Studies carried out with hake. First rules of management

a) The bilateral Commission COFREMAR was established in 1976. At that time, the two Parties had not research vessels, hence foreign vessels were hired to assess the hake stock. Then, catches of hake reached 180 000 tonnes in 1978 (Figure 2).

b) Taking into account the first data obtained for the whole geographic area of distribution of the species, in September 1979 COFREMAR approved Resolution 3/79 which specifies the following statements:

I) To recommend not to exceed the "at that time" level of hake catches.

II) Not to exceed the TAC limit of 200 000 tonnes /year, adapting their respective volumes according to the above objective, until COFREMAR is able to present a plan to the two Parties, about the distribution of the amounts of capture of hake.

III) To study the distribution of catches for the two countries.

c) Distribution of catches. Article 74 of the Treaty establishes the way the catches of the species will be distributed.

d) Joint research

i) In 1984 COFREMAR and the Fisheries Research Institutes agreed to develop a Joint Research Plan about the species of highest commercial value in the geographical area of the Treaty.

ii) Both Commissions agreed that COFREMAR was responsible to coordinate together with the Fisheries Institutes, the joint research about the coastal demersal species.

After a trawl fishing survey in 1984, the Research Plan began in 1985. Figure 3 summarizes the objectives and annual distribution of the 52 surveys carried out for the study of hake and the 36 surveys for the coastal species. COFREMAR has funded 88 research surveys till present.

e) Proposal to modify Resolution N 3/79.

In 1986, 4 seasonal surveys and 3 more in 1987 were carried out to evaluate the hake. Based on the obtained data, a reduction of the TAC, established as 200 000 tonnes/year (II-4 b)), to a value of TAC in agreement with the biological condition of the species, was proposed. Such value was estimated at 130 000 tonnes/year.

Two different opinions resulted from this proposal: (i) there could be a risk of overfishing and signs indicating a decrease of the species; (ii) there were not any indicators that the species was decreasing.

Since there was not a general agreement, the value of 200 000 tonnes/years established in 1979, was maintained till 2000.

f) Evolution of the catches of hake from 1974 till 2001 (Figure 2)

The established maximum value of 200 000 tonnes/year was never attained. A sustainable increase of the Uruguayan catches in the ZCP was reached till 1981 when they exceeded the Argentinian catches. In 1985 Uruguay reached its historical maximum value of 97 150 tonnes. The highest values were got in 1978, owing to the increased tonnes of the Argentinian and the Uruguayan catches together.

In 1991 a yield of 190 000 tonnes was attained, because of the good catches as well as the equivalence of both countries. From 1991, catches of hake have been decreasing.

II.5 **Management and regulations over the control of hake.**

a) Closed areas. Until August 1993 closed areas were established inside the jurisdiction of each country in order to protect the concentration of juveniles of hake. Those measures were taken unilaterally and obligatory applied to the vessels with the flag from the Party responsible for establishing the closed area. Unfortunately, a discriminatory situation was created among the fishing vessels. Closed areas were established in spring, summer and autumn. However, such regulation had the disadvantage of the impossibility of being applied when the concentration of juveniles was extending outside both boundaries of the Lateral Maritime Border. Besides, coordination between the two Parties was really difficult, although not impossible.

b) In August 1993, COFREMAR established that the Commission has the faculty to decide the setting of closed areas in order to protect spawning or nursery areas, to avoid the entrance of hake to polluted areas or to areas where red-tides exist, and establishing obligatory regulations to the authorized fishing vessels.

From then onwards, three annual closed areas have been established in order to protect juveniles in spring, summer and autumn. Those areas are represented by typical diagrams shown in Figure 1. To avoid catches of juveniles which come together with adults in winter, a possibility of establishing closed areas in the cold season is also being considered.

c) Fishing gear. From September 1989, fishing vessels could only use the 120 mm diamond mesh to catch hake and its associated fauna. This regulation was applied till 31st December 2001.

d) COFREMAR has recently established the use of new fishing mesh for selective fishing known as "device to allow juveniles of fishes to escape from the drift net" (DEJUPA) (Ercoli *et al.*, 2000). Its use is compulsory since January 2002.

e) Minimum size. From September 1993, a 35 cm minimum size was fixed to put hake onshore.

f) Total allowable catch (TAC) and limitations to each country. COFREMAR established (item 6.2) the amount of 200 000 tonnes/year the CTP for hake. Such value was allowed till 2000 when a TAC of 90 000 tonnes/year was agreed. Thus, the Commission resolved:

   i) To fix a TAC for hake of 90 000 tonnes/year in the ZCP, from the 1st January 2001.
   ii) To keep an additional amount of 10 000 tonnes/year in case needed to be used, controlled by COFREMAR.
   iii) To distribute the maximum amounts to each country established in the Treaty, according to the following decision:

55 000 tonnes/year to Argentina (61 percent); 35 000 tonnes/year to Uruguay (39 percent).

Such disposition is conditioned to good results in a common system of fishing reports. Equivalent penalties for both countries, observers on board of every fishing vessels and a satellite monitoring system of position and identification of vessels.

II.6 Coastal species, whitemouth croaker and stripped weakfish

a) Whitemouth croaker has its habitat in the Rio de la Plata and the Common Fishing Zone (round 80 percent and 20 percent, respectively). In 1984, COFREMAR agreed to be in charge of coordinating a joint research on coastal species. Thirty six surveys were carried out to study both species (Figure 3).
b) Stripped weakfish has its habitat in the Rio de la Plata and the ZCP as well (round 20 percent and 80 percent, respectively). Stripped weakfish is also a coastal species but more oceanic than whitemouth croaker. Some of these mentioned surveys were carried out to study the two species (Figure 3), others had only one target species, either whitemouth croaker or stripped weakfish.

II. 7 Application of management to control whitemouth croaker.

The progress in the establishment of rules for management and administration of the species whitemouth croaker is shown by the following:

a) Total allowable catch and maximum amount to each country. In July 1996 CARP and CROFEMAR recommended, not to exceed the preliminary upper limit of 40 000 tonnes/year of catch.
b) In September 1996, the two Commissions resolved to fix a provisional total of catch quota of 40 000 tonnes/year and to settle a final volume according to the complementary studies.
c) In May 1997, the two Commissions established the following allocation quotas for the period from 1997 till 1999: (i) Argentina: 17 500 tonnes/year (44 percent); Uruguay: 22 500 tonnes/year (56 percent).

The two Commissions agreed that if one of the involved Parties exceeded its quota, a compensation must be obtained during the following year. The two countries fulfilled the compromises since during 1997, Argentina caught 25499 t (+7999) and Uruguay 23624 (+1124). Thus, a compensation for those exceeding catches was reached in two years, determining the following quota for the years 1998 and 1999: (i) Argentina: 13 500 tonnes/year (1998: 12 781; 1999: 5 733); (ii) Uruguay: 21 938 tonnes/year (1998: 22 253; 1999: 14 650) (Figure 2).

d) In April 1999, the following quota was established, based upon the criteria that was being applied: Argentina: 13 500 tonnes/year; Uruguay: 21 623 tonnes/year.
e) In March 2000 the two Commissions, CARP and COFREMAR, agreed to reduce the TAC to 36 000 tonnes/year, and the same for 2001 in a system of olympic catches. The TAC for 2002 has not been determined.
f) Management. In February 2002, CARP and COFREMAR approved Resolution 1/02 concerning the assessment, conservation, protection and rational exploitation of whitemouth croaker and stripped weakfish. The following statements were established:

   i) The two Commissions agreed to be responsible for the assessment, conservation, protection and rational exploitation of the species whitemouth croaker and stripped weakfish inside the area of the Treaty, including the setting of one TAC, the establishment of closed areas and the technical characteristics of vessels and fishing gear.
   ii) Regarding the distribution of fishing quotas, each Commission must be adapted to what the Treaty establishes.
   iii) The management and research of whitemouth croaker will be the responsibility of CARP whereas that for stripped weakfish COFREMAR.
   iv) The decisions regarding conservation, protection and management of the mentioned living resources will be taken through joint resolutions.

g) Closed areas. At present the determination of a closed area is under study to protect concentration of reproductive whitemouth croakers.
h) Fishing gear. Two surveys were carried out to determine a selective fishing gear similar to the type that is used for hake fishing. The resulting device (DEJUPA/whitemouth croaker) turned out to be successful

for the species. However, it could not be used yet, since it cannot be applied together with the associated fauna like Stripped weakfish and Patagonian smoothhound. Possible solutions are being analyzed. For this species a 120 mm diamond gear is employed.

i) Minimum size. The two Commissions established a minimum size of 32 cm to unload onshore.
j) Protection rules. Fishing vessels of more than 21,99 m length are forbidden to catch whitemouth croaker at the west side of the indicated line in the Rio de la Plata (Figure 1).
k) Vessels of more than 28 m length are forbidden to catch whitemouth croaker, stripped weakfish and other demersal species at the NW side of the line traced in the ZCP (Figure 1).

II.8 Application of management to control stripped weakfish

a) Management. The same rules of management established for whitemouth croaker in the item II-7 f), are applied to stripped weakfish. Because this species is more oceanic than whitemouth croaker, its management is under the responsibility of COFREMAR. All decisions of common interest, regarding conservation, protection and management of this resource, are taken through joint resolutions of CARP and COFREMAR
b) Closed areas. Every year in summer, a closed area is established to protect concentrations of juvenile stripped weakfish. Figure 1 shows the typical outline of the closed area applied for the first time during the summer 2000, and annually repeated.
c) Fishing gear. A survey was carried out to determine the selective fishing device, the one employed for hake (DEJUPA / stripped weakfish). However, its use has not been determined yet, since it cannot be applied to zones where this species coexists with whitemouth croaker and with another associated fauna. Possible solutions are being analyzed.
d) Minimum size. COFREMAR established 30 cm to be the minimum size to unload stripped weakfish onshore (October/99). A joint resolution needs to be established.
e) Total allowable catch. COFREMAR established 23 000 tonnes / year in 2001. In 2002, an equal estimation of 23 000 tonnes has been determined. A joint regulation needs to be established. Amounts for each country have not been established yet, thus the olympic system is applied.
f) Protection rules. Vessels of more than 28 meters length are forbidden to catch whitemouth croaker, stripped weakfish and demersal species, at the NW side of the line in the ZCP (Figure 1).

II.9 Other commercial species

Other commercial species caught in the Common Fishing Zone and rules for their control will be described.

II.10 **Squid (*Ilex argentinus*).** This resource comes into the ZCP in summer and autumn, as part of the migratory movement which belongs to the Bonaerense-Northpatagonic population (Brunetti y Pérez Comas, 1989).

COFREMAR establishes the dates when harvesting activities must begin and end.

Neither TAC nor quotas by countries have been established. Catches carried out during the period 1989/2001 show an irregularity, may be due to fluctuations of the cost of squid in the world market and, to the variation of the oceanographic conditions since squid is a thermophilic species.

II.11 **Anchovy (*Engraulis anchoita*).** This species has a key ecological role inside the trophic chain of the ecosystems belonging to the Maritime Front.

a) Minimum size. COFREMAR established a minimum size of 120 mm, with a tolerance limit of 10 percent in number, for anchovies of smaller size.
b) Closed areas. A permanent closed area has been established to protect a nursery area which is shown in Figure 1.
c) Night fishing of anchovy with a mid water trawl has been forbidden.
d) Total allowable catch. A research survey to determine an advisable biological catch is being programmed to be carried out. Every project considering anchovy as an objective will need to include a biological research to hold its protection.

II.12 Bastard halibut, Argentine seabass, Brazilian flathead, Patagonian smoothhound and red porgy

COFREMAR established the TAC of these species during 2002, based on the recommendations of the Fisheries Institutes, regarding protection and conservation reasons (Table 1).

TABLE 1. TACs for several species belonging to the Common Fishing Zone from Argentina and Uruguay.

Spanish name	English name	Scientific name	CTP
Lenguado	Bastard halibut	*Paralichthys patagonicus*	4 200 t
Mero	Argentine seabass	*Acanthistius brasiliensis*	1 290 t
Pez palo	Brazilian flathead	*Percophis brasiliensis*	4 200 t
Gatuzo	Patagonian smoothhound	*Mustelus schmitti*	4 850 t
Besugo	Red porgy	*Sparus pagrus*	1 270 t

Limits of distribution by country have not been established.

II.13 Chondrichtyes

During the XVst Scientific Symposium of COFREMAR, a round table was held in order to discuss about chondrichtyes (rays and sharks). The first steps for an adequate management of these species were analyzed. These species are migratory, with low reproduction as well as low recruitment rate. Biomass of these species has been decreasing. Thus, in order to protect them, the following statements were proposed in order to protect them: i) to fix a TAC for Patagonian smoothhound; ii) to decrease the fishing effort on chondrichtyes (Lasta, 2000, en prensa; Paesch y Domingo, en prensa; Massa y Hozbor, en prensa).

III. REQUISITES ASKED BY FAO ABOUT CRITICAL TOPICS THAT ALTER THE EFFECTIVENESS AND MANAGEMENT OF SHARED FISHERY RESOURCES.

III.1 Management regulations

The management regulation are established in the Treaty, which is a kind of cooperative agreement approved in 1974. It provides the legal framework within which both countries, Argentina and Uruguay, develop their fishing activities. The Treaty is based upon the shared history of the two neighbouring and friendly countries.

The Treaty establishes as one of its objectives, a fishing agreement for the use of: 1) the common fluvial waters of the Rio de la Plata, and 2) the marine waters the two Parties agreed to share, the Common Fishing Zone (ZCP).

III.2 Political will of the national authorities to promote cooperative management.

The political will is written in the introduction of the Treaty. The two countries, through their representatives established, in a friendly and harmonic spirit, the background for a wide-ranging cooperation based on the documents published in 1910, 1961 and 1964. Thus, the Treaty was signed to provide for definitive solutions to the problems that had been appearing throughout the history. It is based on the historical respect of the sovereignty and the rights and interests of the two countries.

III.3 Institutional agreements and capability of the authorities to promote the fisheries management

The Treaty, the legal framework for the shared fisheries, is an agreement where first two bilateral Commissions were established: CARP to administrate the Rio de la Plata, and COFREMAR, to administrate fisheries in the Common Fishing Zone and to protect the marine environment. The two Commissions are comprise five delegates from each country representing the involved institutions that are considered in the Treaty. The two Commissions have the capability and the institutional power to take rational decisions based upon the gathered data and the fisheries research, in order to manage shared resources. Advisers from the Fishing Industry, belonging to each of the two delegations, participate in the Commissions. Resolutions

taken by the two Commissions, either separately (for hake) or jointly (for whitemouth croaker and stripped weakfish), have validity and are accepted by the two Parties.

III.4 Procedures and criteria on taking decisions to distribute the shared resources, based upon transparent and equal criteria.

The Treaty has two criteria for the distribution of the shared resources, either they are resources caught in the Rio de la Plata, or in the Common Fishing Zone.

a) Rio de la Plata.

The following condition is established:

"The two Parties will agree about the maximum volumes of catches by species as well as the corresponding periodical setting of total allowable catches (TACs). The TACs will be equally distributed between the two Parties.

To get those purposes CARP must:

"dictate the rules to regulate the fishing activity in the river, regarding conservation and protection of living resources".

b) Common Fishing Zone. The distribution of volumes of catch by species is based upon three criteria (Art. 74 of the Treaty):

(i) Equity in the distribution.
(ii) Proportionality based on each Parties' contribution to the ichtic abundance.
(iii) Assessment of ichtic abundance according to scientific and economic criteria.

Different interpretation of such article arose between the two Parties. Each country took its own position regarding what they considered an equitable distribution. In addition, a great complexity of different opinions was taken into account, about the meaning of the scientific and economic criteria to evaluate the contribution of icthic abundance.

The duality on the interpretation of Article N° 74 remained until December 2000 when the volumes of catch for each country were established, whose standing depended on the fulfillment of certain conditions.

III.5 Giving facilities to new fishermen. (Art. 63-paragraph 2 Law of the Sea)

The Treaty establishes that:

a) Fishing vessels legally enrolled, which belong to either of the involved Parties, are able to operate in the Common Fishing Zone. Hence a bilaterally fishery is established.
b) If one of the Parties authorizes third flag vessels to catch a fixed volume, this will be charged to the corresponding quota of the involved Party.

The geographical area of distribution of the main commercial species, are beyond the Common Fishing Zone, in the following cases:

Hake, based on the specific oceanographic conditions of the species, is in the north of the lateral maritime border between Uruguay and Brazil, being caught by Brazilian vessels. Those catches are not significant. Besides, the unit of northern management for hake exceeds the Common Fishing Zone, since it reaches the 41° South Latitude.

Whitemouth croaker and stripped weakfish are species found in every coast in South America. Both species are at the sides of the lateral maritime border between Uruguay and Brazil. An agreement with Brazil, about

volumes and quota of catches was not necessary. Both species are also extending very far from the ZCP, to the Argentinian Exclusive Economic Zone (ZEE Argentina).

III.6 New member rights

Fisheries shared by Argentina and Uruguay in the Common Fishing Zone have a bilateral character. The Treaty does not consider the incorporation of new members.

III.7 Mechanisms for sharing functions and responsibility in the management of fisheries. How to share the cost of management.

The bilateral Commissions, CARP and COFREMAR, comprise delegates from the two countries. Every month, Plenary Meetings are held in order to discuss fisheries topics and to establish resolutions with rules of management about conservation of species. Resolutions are: a) valid inside the jurisdiction of each Commission, b) obliged to be fulfilled and c) published in the Official Newspapers of both countries.

The Commissions have the responsibility to fund the research plans that originate the rules of management.

III.8 Prevention and elimination of illegal fisheries activities

Inside the Common Fishing Zone, each country fulfills functions of control and custody of their corresponding jurisdictions. Such activities are carried out by the Navies and Coastguards which received the list of vessels authorized to fish from COFREMAR.

In the Rio de la Plata, there is an agreement among the Coastguards from the two countries to interchange information about the authorized vessels that are fishing. When vessels arrived at their tying harbour, they must give a Fishing Report which is a legal declaration.

IV. PRACTICAL PROBLEMS ARISING FROM THE MANAGEMENT OF FISHERIES RESOURCES

IV.1 Application of the Treaty

a) Since the beginning of the fulfillment of the Treaty, difficulty to apply Article 74 which deals with the distribution of catches was seen, because each one of the Parties had a different interpretation of the text, causing delays in getting agreements.

b) Difficulties also appeared regarding the volumes of catches to be fixed by species, based upon Article 82. a), a function that must be performed by COFREMAR. Taking into account the particular case of hake, this Commission established a TAC value in 1979, which has been applied until December 2000, when a new value was set. The establishment of a new TAC value was due to the lack of agreement between the two Parties during the period 1979 – 2000. Neither of them agreed about new values of TAC taking into account the real state of the resource. This situation contributed to the over-fishing state because of the lack of a TAC update.

c) Regarding the distribution of TAC for each country (Art. 74), the Treaty establishes the criteria of equity and proportionality of the ichtic abundance provided by each Part, and evaluated according to the scientific and economic criteria. However, in practice, distribution was complex to be resolved because of the great number of parameters that were taken into account and the various assessment methodologies.

d) Argentina and Uruguay contribute with an annual fee of similar amount in order to allow the two Commissions as well as fisheries research and study, to work. Unfortunately, the fees are irregularly received, which causes lack of fund during some years. At present, the two governments have two years of debt, making both Commissions to stop the research plan and the meetings of the study groups. Another difficulty arising from this inconvenience is the discontinuity of the performance of the Plan of

Surveys, meaning a lack of information on the state of resources, hence impeding a rational following up of its evolution.

IV.2 State and management of the resources

a) Research Plan

The information about the state of resources is obtained from the Plan of Joint Research Surveys which is partially supported by funds from the Commissions (oceanic research COFREMAR and coastal research CARP/COFREMAR). The Fisheries Institutes from the two Parties DINARA (ROU) and INIDEP (RA) cover the cost of research vessels which carry out the fishery research (three research vessels from Argentina and one from Uruguay) with financial resources coming from their own funds.

b) Situation of hake. Recommendations for its management (Bezzi, 2002).

In 1984, a program of studies and research was initiated to evaluate and rationally exploit the hake. From the obtained results, tendencies were observed, making it necessary to adequate the TAC to the state of the resource, fixing it at 90 000 tonnes / year from 2001 (Resolution COFREMAR N° 9/2000).

Based upon the studies carried out, the following symptoms of the state of resource were determined: an increasing tendency of fishing mortality rate and a decreasing tendency of CPUE during the period 1986-1996 (Figure 4). The total biomass of the unit of northern management decreased. Recruitment (age 2) decreased. The fishing stock is overexploited. Adult species tend to disappear. The reproductive biomass is below the acceptable biological values. Total catches have been decreasing. The abundance of hake is very low, most of it consisting of juveniles. When delimiting the concentration areas of juveniles in the last surveys, a marked decreasing density was observed.

In December 2000 (Resolution COFREMAR N 9/2000) allocation of TAC among the two Parties was agreed upon. Thus, for Argentina, 55000 t/year (61 percent) and Uruguay, 35000 t/year (39 percent). The accomplishment of the distribution to each country is conditioned by the existence of: a common system of Fishing Reports], a regime of common penalties, observers on board of every vessel and a system of satellite positioning. At present the achievement of a common system of Fishing Report and of satellite positioning is being established. There is a delay in the fulfillment regarding the regime of common penalties and of observers on board.

Taking into account the over-exploitation of the resource and the decrease of the total and reproductive biomass (Figure 4), one of the Parties suggested closing the Fishing Area of hake during one year as an emergency regulation. However the idea was not accepted.

Experts were called in order to give a diagnosis and suggestions about the management of the resource. Such work has not been finished yet, but one of the Parties made suggestions which must previously be accepted to be presented as a recommendation. The most important of those suggestions are:

(i) to reduce the TAC drastically;
(ii) to reduce the fishing effort;
(iii) to protect breeding areas of juveniles during the four seasons of the year (to establish closed areas also in winter);
(iv) to protect concentration areas of reproductive adults between the months of May and August, from 35° to 37° S and between 50 and 200 m depth. This regulation has never been adopted in the unit of northern management at 41° S.
(v) to control the use of devices of selectivity;
(vi) to have observers on board.

c) State of coastal demersal resources: whitemouth croaker and stripped weakfish.

CARP and COFREMAR carry out the management of these species together, because their geographical area of distribution includes part of the Rio de la Plata and part of the Common Fishing Zone.

In 1985, a program of studies and research was initiated to evaluate and rationally exploit the species whitemouth croaker and stripped weakfish. Fourteen surveys were carried out to delimitate coastal concentration areas of juveniles of whitemouth croaker, two surveys to determine reproductive areas and one to evaluate stripped weakfish and its area of summer concentration of juveniles. Besides, two surveys for selectivity of both species and two more for whitemouth croaker exclusively, were also carried out.

An over-exploitation state of whitemouth croaker is observed (Carozza, 2002), confirmed by the decrease of catches, the significant decrease of the CPUE during the period 1989 – 2001(Figure 4) and the declaration of fishermen who observed a marked decreasing in density, particularly on the Argentinian coast.

Regarding the selective fishing mash, DEJUPA for whitemouth croaker and stripped weakfish is defined, although it cannot be applied yet, since it is impossible to be used in the zones where both species coexist with other coastal species.

TAC for whitemouth croaker was fixed at 40 000 tonnes/year by the two Commissions, CARP and COFREMAR during the period 1997 – 1999, and reduced to 36 000 tonnes/year in 2000 and 2001; the corresponding TAC for 2002 has not been established yet.

The working group composed of specialists on this species, recommended: to establish a closed area to protect the concentrations of reproductive adults, to maintain the polygonals of protection to avoid: a) vessels of 21.99 m maximal length to operate west of the northern polygonal, and b) vessels of more than 28 m maximum length to operate north west of the NE-SW polygonal. Besides, the minimum size to unload the species onshore must be maintained.

The working group of specialists of stripped weakfish (Carozza y Ruarte, 2002) considered the catches for the period between 1989 – 2001 (Figure 4) and the CPUE, observing a light increasing, and recommended: a) to maintain the TAC at 23 000 tonnes/year established for 2001; however ratification for 2002 is lacking; b) to continue, the closed area of concentration of juveniles of the northern Uruguayan coast, in summer (Figure 2) and c) to maintain the polygonal NE-SW (Figure 2) that forbids the fishing vessels of more than 28 m maximum length to operate NW of it.

d) Other commercial species

Squid: Each year COFREMAR establishes the beginning and ending of the harvesting season. Owing to the variation regarding the movement of this stock to the ZCP and the lack of means to carry out research surveys to study this species, the Commission takes into account the information coming from Argentina, then it is not necessary to establish a TAC. There is a considerable irregularity in the values of total catches and for each country, probably owing to the fluctuation of prices in the market and to variations in the abundance of squid. Selective fishing gear to catch the species have not yet been decided upon.

Anchovy. The expert Group for this species recommended: to establish a minimum size to unload the species onshore, to forbid night fishing and to settle a permanent closed area to protect the breeding area of juveniles (Figure 1). Research surveys to fix a TAC for this species still needs to be established.

Bastard halibut, Argentine seabass, Brazilian flathead and red porgy. COFREMAR establishes the TAC for these species for 2002.

Chondrichtyes (rays and sharks). COFREMAR establishes a TAC for the Patagonian smoothhound and started the consideration of other species in order to protect their biomass (Table 1).

IV.3 **Preservation of the fluvial and marine environment**

In 1997 the Argentinian and Uruguayan governments, represented by the two Commissions CARP and COFREMAR, signed an agreement with UNDP / GEF to start a "Project of Environmental Protection of the Rio de la Plata and its Maritime Front: Prevention and Control of Pollution and Restoration of Habitats" This Project began in February 2000 and is intended to last for three years and a half. The result to be obtained

consists of carrying out a Transboundary Diagnostic Analysis (ADT) and to establish a Strategic Action Plan (PAE).

IV.4 **Conclusions**

The species hake and whitemouth croaker are over-. Hence management regulations have been taken to recover the stocks of those species exploited (Bezzi *et al.*, 2002; Carozza *et al.*, 2002).

The annual plan of research surveys are not being carried out, because both Commissions, CARP and COFREMAR do not have any financial support to continue such surveys.

TACs have been established for several commercial species but owing to their lower biomass, they do not constitute an alternative to hake.

A reduction of biomass of the group of chondrichthyes is observed. Management regulations are being considered.

A project on Environmental Protection has been initiated to prevent and control pollution for the restoration of habitats.

V. BIBLIOGRAPHY

ARENA, G. 1990. Evaluación de la captura máxima sostenible de la corvina blanca (*Micropogonias furnieri*) presente en el área operativa de la flota uruguaya, mediante modelos de producción excedente. Frente Marítimo, Vol. 7, Sec. A: 25-35.

BEZZI S. Y C. DATO. 1993. Distribución estacional de los juveniles de merluza (*Merluccius hubbsi*) en la Zona Común de Pesca. Período Otoño 1986 - Verano 1987. Com. Téc. Mix. Fr. Mar. Vol. 14, Sec. A: 7 – 22.

BEZZI, S., G. IRUSTA, P. IBAÑEZ, M. SIMONAZZI Y F. CASTAÑEDA. 2000. La pesquería argentina de merluza (*Merluccius hubbsi*) en la Zona Común de Pesca. Periodo 1986-1996. Frente Maritimo, Vol. 18, Sec. A: 7-23.

BEZZI, S., M. RENZI Y M. PEREZ. 2002. Diagnóstico del estado del recurso merluza y sugerencias de manejo realizadas por el INIDEP. Informe Técnico INIDEP N° 049.

BEZZI, S. Y M. REY. 1992. Informe sobre los resultados de la campaña conjunta para la evaluación de la merluza (*Merluccius hubbsi*) durante la primavera de 1992. Com. Téc. Mix. Fr. Mar. Circular N° 3: 1-13.

BEZZI, S., M. REY, R. CASTRUCCI, E. CHIESA, J. SWIDZINSKI, L. PAESCH, P. IBAÑEZ, M.I. LORENZO, M. RENZI, W. NORBIS. 2000. Informes sobre los resultados de las campañas conjuntas para determinar concentraciones de juveniles de merluza realizadas en 2000 y 2001. Circulares COFREMAR N° 1/01, 2/01, 3/02 y 4/02.

BEZZI, S. y L. TRINGALI. 2002. Areas de reproducción y áreas de crianza de la merluza (Merluccius *hubbsi*): antecedentes científicos y relación con su mareo regulatorio en la República Argentina. Frente Marítimo, Vol. 19 (en prensa).

BRUNETTI, N.E. y J.A. PEREZ COMAS. 1989. Abundancia, distribución y composición poblacional del recurso calamar (Illex argentinus) en aguas uruguayo-bonaereneses en mayo, setiembre y noviembre de 1986 y en marzo y mayo de 1987. Frente Maritimo, Vol. 5: 39-59.

CORDO, H. 1986. Estudios biológicos sobre peces costeros con datos de dos campañas de investigación realizadas en 1981. III. La pescadilla de red (*Cynoscion striatus*). Publ.Com.Téc.Mix.Fr.Mar., Vol. 1(1): 15-27.

Documentos Básicos. Folleto editado por la COFREMAR, edición de junio de 1998.

EHRHARDT, N. Y M. REY. 1993. Cálculo de los descartes de juveniles en la pesquería de la merluza común (*Merluccius hubbsi*) en el Atlántico Sudoccidental. Frente Marítimo, Vol. 16, Sec. A: 29-37.

ERCOLI, R, J. GARCIA. A. AUBONE, L. SALVINI y A. IZZO. Selectividad del sistema DEJUPA-COPO en la pesquería de merluza (*Merluccius hubbsi*) mediante el uso de copos con mallas diamante de 100 y 120 mm de luz. En prensa. Frente Marítimo, Vol. 19.

LASTA, C. Y M. ACHA. 1993. Cabo San Antonio: Su importancia en el patrón reproductivo de peces marinos. Frente Marítimo, Vol. 16, Sec. A: 39-45.

MASSA, A. Y N. HOZBOR. Peces cartilaginosos de la Plataforma argentina: explotación, situación y necesidades para un manejo pesquero adecuado. En prensa.

Mesa de Debate sobre Condrictios. Décimoquinto Simposio Científico de la Comisión Técnica Mixta del Frente Marítimo. 2002. Vol. 19 (en prensa).

PAESCH, L. Y A. DOMINGO. Consideraciones sobre los condrictios en el Uruguay. En prensa. Frente Marítimo, Vol. 19.

REY, M. Y S. BEZZI. 1993. Informe sobre los resultados de la campaña conjunta para delimitar el área de veda de juveniles de merluza (*Merluccius hubbsi*) (Otoño de 1993). Com. Téc. Mix. Fr. Mar. Circular N° 5: 1-13.

REY, M. Y S. BEZZI. 1994. Resultados obtenidos durante las campañas para la delimitación y monitoreo del área de veda de merluza, Primavera 1993. Com. Téc. Mix. Fr. Mar. Circular N° 6: 1-22.

REY, M. Y S. BEZZI. 1994. Resultados obtenidos durante las campañas para la detección y delimitación de áreas de concentración de juveniles de merluza (*Merluccius hubbsi*). Otoño 1994. Com. Téc. Mix. Fr. Mar. Circular N° 7: 1-18.

M. REY, S. BEZZI, G. VERAZAY Y J.ORIBE STEMMER. 1993. Areas de veda para la protección de los juveniles de merluza (*Merluccius hubbsi*) en la Zona Común de Pesca, hasta diciembre de 1993. Frente Marítimo, Vol. 16, Sec. A: 7-27.

REY M. Y P. GRUNWALDT. 1986. Evaluación de la merluza (*Merluccius hubbsi*) en la Zona Común de Pesca Argentino-Uruguaya. Verano 1982. Publ. Com. Tec. Mix. Fr. Mar. 1(1): 121-134.

REY, M., J. CASCUDO, S. BEZZI Y G. VERAZAY. 1993. Análisis de algunas poblaciones de la fauna acompañante de la merluza. Rangos de distribución, concentración y rendimientos. Período Otoño 1986 - Verano 1987. Com. Téc. Mix. Fr. Mar. Circular N° 4: 1-26.

SIMONAZZI, M. Y H. CORDO. 1986. Aspectos de la estructura de población de la merluza común (*Merluccius hubbsi*). Largo y edad de primera madurez, relación largo-peso. Publ.Com.Téc.Mix.Fr.Mar., Vol. 1(1): 135-146.

UBAL, W., W. NORBIS, B. BOSCH Y D. PAGANO. 1985. Principales factores determinantes de la abundancia de la merluza (*Merluccius hubbsi*) en otoño en la Zona Común de Pesca. Publ. Com.Téc.Mix. Fr.Mar., Vol. 3: 7-13.

UBAL, W., W. NORBIS, B. BOSCH Y D. PAGANO. 1985. Estudio del stock desovante de la merluza (*Merluccius hubbsi*) en la Zona Común de Pesca. Publ. Com.Téc.Mix. Fr.Mar., Vol. 3: 59-66.

ANNEX: MAPS AND TABLES

CHART OF THE COMMON FISHING ZONE

PROTECTION LINES

CLOSED AREAS

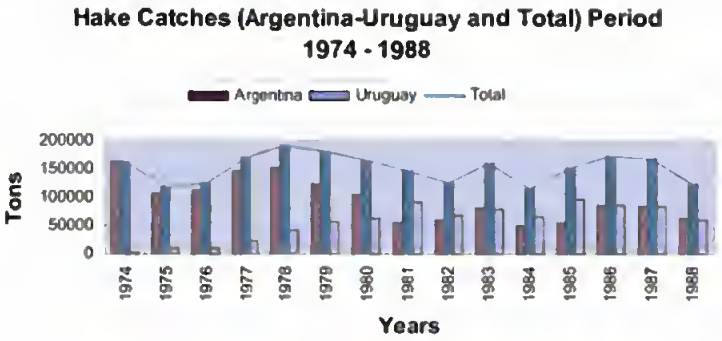
HAKE SPRING HAKE SUMMER HAKE FALL

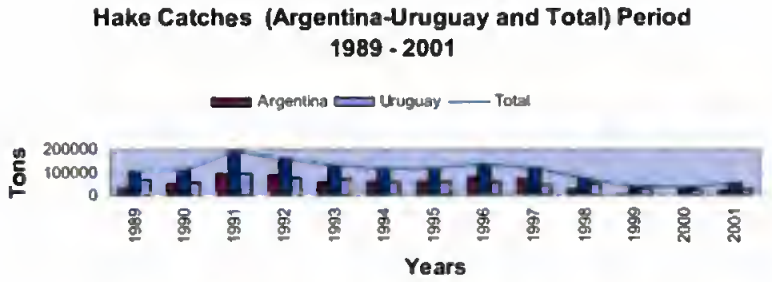
STRIPPED WEAKFISH ANCHOVY

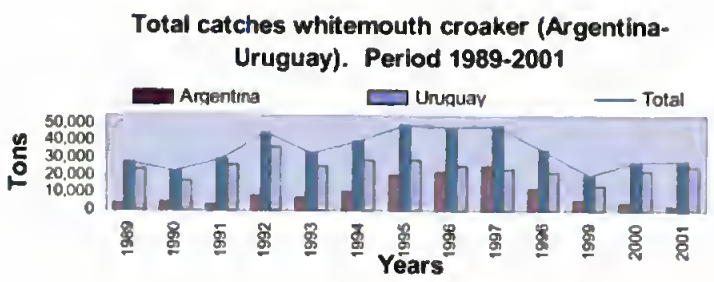
Figure1

CATCHES

SOURCE: INIDEP & DINARA. 1974 - 2001







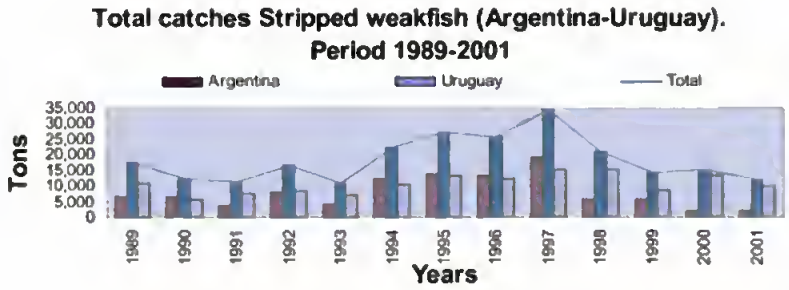


Figure N°2

COASTAL RESOURCES RESEARCH 1984-2002

	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	Total
Evaluation(1)		2			1	1		1	1	2	1	1				2	1	1		14
Selectivity					1 (1)										1 (2)		1 (1)	1 (2)		4
Juveniles							1	6	4	2								1	1	15
Reproduction area									1				1							2
Stripped Weakfish																1				1
Totals		2			2	1	1	7	6	4	1	1	1		1	3	2	3	1	36

• 1) Whitemouth croaker and Stripped weakfish (2)Whitemouth croaker

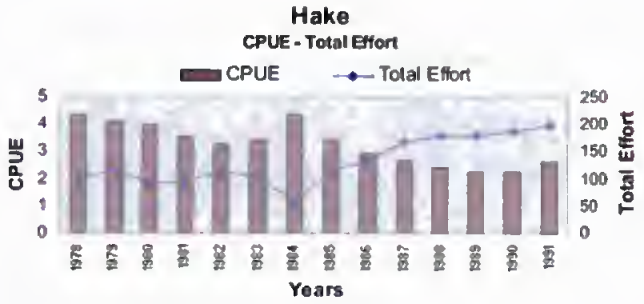
HAKE RESEARCH 1984-2001

	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	Total
Evaluation			4	3	3	1			1	2	1	1			1					17
Fishing Power	1			1						1										3
Closed area									1	3	3	3	3	3	3	3	3	2		27
Selectivity																1				1
Squid															2					2
Totals	1		4	4	3	1			2	6	4	4	3	3	6	4	3	2		50

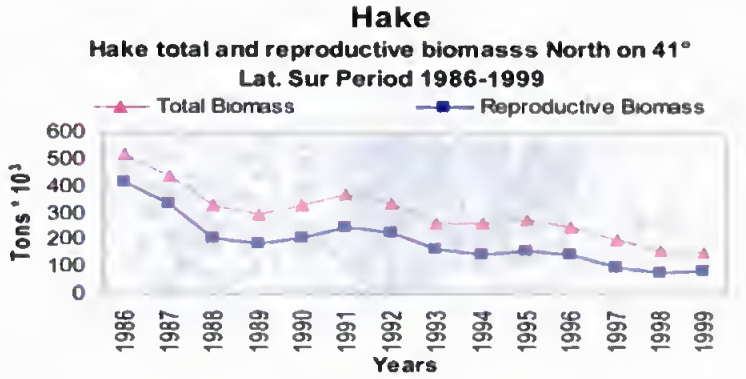
SOURCE: COFREMAR SEC. TEC.

Figure N° 3

CPUE & BIOMASS



SOURCE: INIDEP DOC. CIENT., 3 (1994) TABLA 7



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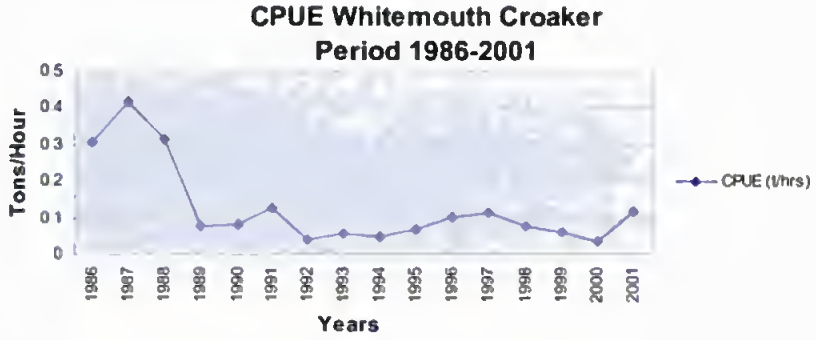

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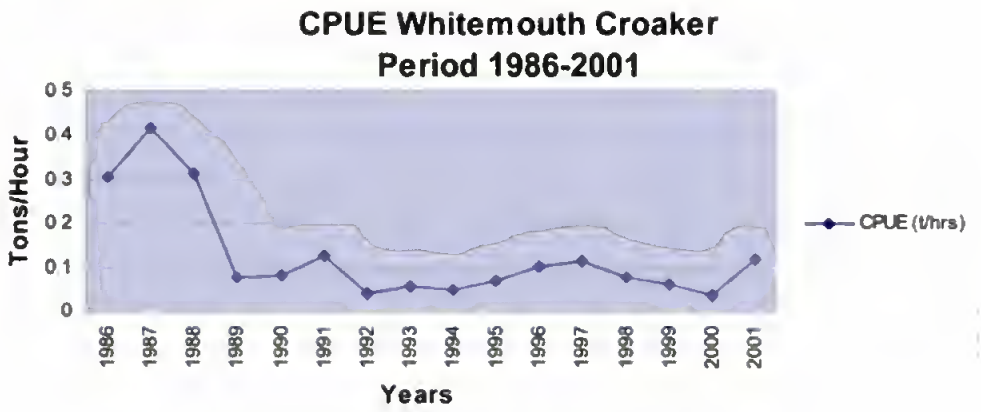
SOURCE: INIDEP INF. TEC. INT., 39 (2002)

Figure N°. 4



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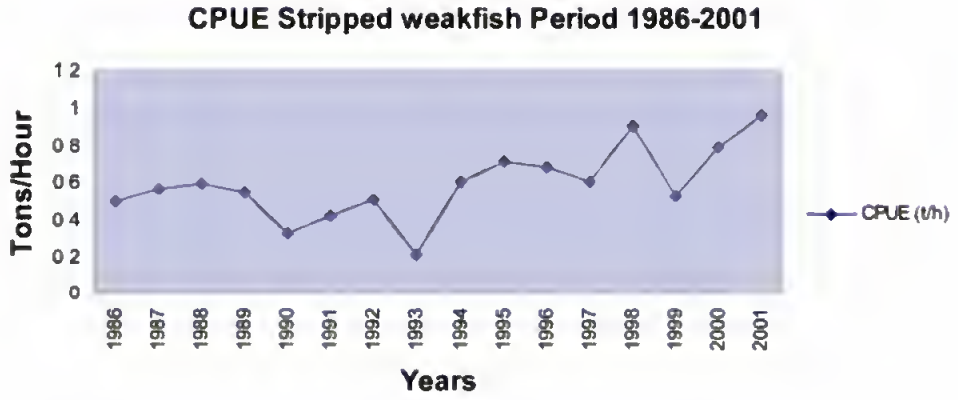

SOURCE: INIDEP INF. TEC. INT., 39 (2002)

NORTH AMERICAN PACIFIC SALMON: A CASE OF FRAGILE COOPERATION

by

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INTRODUCTION

The United States and Canada have a long and rocky history of alternating between cooperating on joint management of Pacific salmon harvests and squabbling over their respective shares of the catch. In June 1999, the two nations signed the Pacific Salmon Agreement, which amends the 1985 Pacific Salmon Treaty[1] (U.S. Department of State, 1999). In so doing, they emerged from a six-year period of discord marked by bickering, failed negotiations, and conservation-threatening harvest practices. Their hope is that the new agreement will provide a foundation for stable, mutually beneficial cooperative management of these fisheries. In reaching the agreement, the two nations consented to temporarily set aside a long-smoldering dispute about the equitable division of the harvest and to focus on implementing multi-year abundance-based harvesting regimes that would foster conservation and restoration of depressed salmon stocks. This recent progress, as well as difficulties that have been encountered over the years, may provide lessons for other fisheries agreements.

In many respects, Canada and the United States are well situated to achieve cooperative management of these fisheries. During the UN Third Conference on the Law of the Sea, Canada and the United States cooperated in insisting that LOSC Article 66 be adopted, which effectively banned directed high seas fishing for salmon (Burke, 1991; United Nations, 1982). Specifically, Article 66(1) of the LOS Convention directs that "[s]tates in whose rivers anadromous stocks originate shall have the primary interest in and responsibility for such stocks."[2] The primary purpose of Article 66 – strongly supported by both Canada and the U.S. – is to prevent high seas fishing for salmon and other anadromous fish.

This largely eliminated Russian and Japanese interceptions of North American salmon and left Canada and the U.S. free to jointly manage their salmon stocks as "shared" fishery resources. Although rumors about illegal, unreported catch on the high seas circulate from time to time, there is little evidence that such activity has a significant impact on North American salmon stocks. Even though the two nations are free from the complication of high-seas interceptions, the coordination problem for North American Pacific Salmon is complicated and involves at least 4 major players: Canada, Alaska, Washington/Oregon and 24 Treaty tribes located in Washington, Oregon and Idaho. In addition, most of these players must contend with competition among sub-units (e.g. competing commercial, sport and Native American/First Nations harvesting groups) for access to the salmon resources. The four major players differ in their management objectives and levels of bargaining power. Furthermore, both management objectives and the balance of bargaining power have changed over time.

Unfortunately, neither the 1985 Pacific Salmon Treaty, nor the earlier Fraser River Convention[3] were well designed to accommodate such changes. As incentives to cooperate shifted, disputes ensued. Two major periods of discord can be identified. The first lasted for roughly two decades prior to the signing of the 1985

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[1] Pacific Salmon Treaty, March 18, 1985, U.S.-Can., 99 Stat. 7 [codified at 16 U.S.C. 3631-3644 (1997)].
[2] U.N. Law of the Sea Convention, December 10, 1982 at art. 66 (1).
[3] Convention for the Protection, Preservation and Extension of the Sockeye Salmon Fishery in the Fraser River System, May 26, 1930, U.S.-Can., 8 U.S.T. 1058.

Pacific Salmon Treaty (Munro and Stokes, 1989). The second ran for six years prior to the conclusion of the new Pacific Salmon Agreement in June 1999 (Huppert, 1995; McDorman, 1998a; Munro *et al.*, 1998; Miller *et al.*, 2001).

One of the most prominent features of the Pacific salmon case is the fact that environmental shocks have played a major role in destabilizing efforts to cooperatively manage these fisheries. For example, the most recent period of disarray was fueled by a dramatic increase in northern salmon abundance, coupled with declines in southern stocks. These trends upset the expected division of benefits under the terms of the 1985 Treaty.

Another critical factor in the history of U.S./Canadian negotiations over Pacific salmon is the existence of pronounced asymmetries among the players. These are driven by the impacts of salmon migratory behavior on access to shared stocks, by differences in the relative productivity and resilience of various salmon populations, and by differences in commercial, cultural and aesthetic valuations of the resources. The significance of such asymmetries was enhanced by the fact that until recently, the parties had considered only a narrow range of options for sharing the benefits of the fishery and had ignored the potential role for side payments. Specifically, bargaining had focused primarily on defining commercial harvest shares, with the benefits accruing to each jurisdiction coming only from its own harvests. This narrow approach, together with the fact that the parties often tended to ignore the reality of one another's individual rationality positions and differing management objectives, severely hampered their efforts to find cooperative solutions. Whenever cooperation broke down, aggressive competitive harvesting tended to deplete stocks and reduce the rents derived from the shared resources.

The1999 Pacific Salmon Agreement represents a break from the past in that, for the first time, side payments are implicitly incorporated in the agreement. This provides greater flexibility and allows the distribution of benefits to be effectively decoupled from the allocation of commercial harvests.

At present, the new agreement has been in place for nearly three full fishing seasons, allowing for relatively peaceful operation of these fisheries. Although the success of the agreement is yet to be determined, it appears to have laid the groundwork for improved cooperative management of these shared stocks. Ultimate success can only be judged by the extent to which the agreement facilitates stable cooperation over the long term, while promoting such diverse goals as preservation and restoration of salmon resources, efficient management of fisheries, and a mutual perception that the distribution of the benefits is equitable.

Like the previous arrangements, this new agreement will have to stand the test of changing conditions. The changes now challenging the Pacific salmon industry include dramatic declines in prices for commercially harvested fish as a result of increased competition from the farmed salmon industry, and restrictions on harvesting levels and methods designed to protect fragile stocks. In addition, natural fluctuations in stock productivity will continue. Recently, there has been some evidence of a reversal of the trends of the past two decades, in that many southern stocks are rebounding, while some Alaskan stocks have declined. There also have been some puzzling changes in the migratory behavior and survival characteristics of some salmon stocks that will significantly reduce the potential contribution of those stocks to each nation's fisheries. Specifically, over the past few years, some of the Fraser River's late sockeye runs have entered the river several weeks earlier than their historical pattern only to die in massive numbers prior to spawning (PSC, 2002).

NATURE OF THE RESOURCES AND FISHERIES

Pacific salmon are anadromous fish. In other words, the adults migrate from the ocean to spawn in rivers and streams. After hatching, the juveniles spend a period of weeks to years in the freshwater (depending on species and stock), then disperse into the ocean environment where they feed and mature before returning to their natal streams to spawn and die (Pearcy, 1992). While some salmon stocks remain in coastal areas throughout their lives, many others spend a year or more in a long-distance migration across the feeding grounds of the subarctic Pacific. As a result of their homing behavior, there are literally hundreds of biologically distinct salmon stocks spawning in streams and rivers along North America's west coast.

Many of the salmon stocks originating in the rivers of western North America are transboundary resources because they cross interstate and EEZ boundaries during their oceanic migrations. Most stocks follow a general pattern of swimming north as juveniles to feed in more productive waters and then return along the coast from north to south as they head to their spawning streams (see Figure 1).

Figure 1

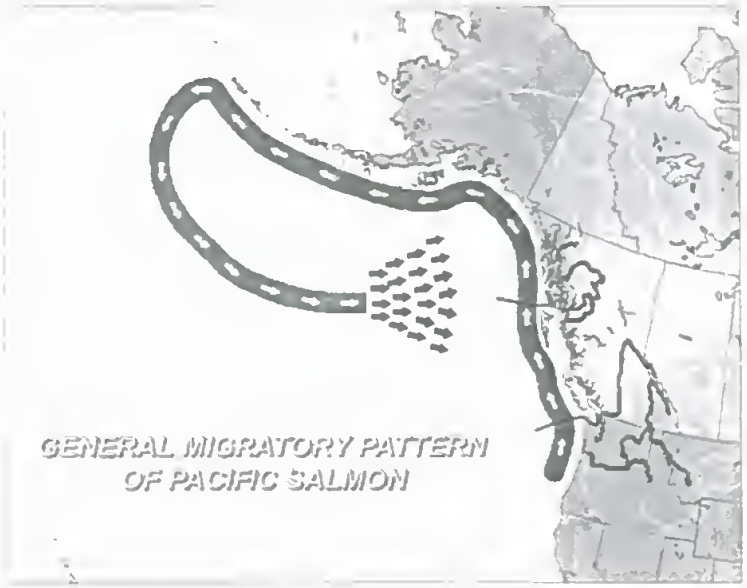


Figure 1
Source: Canada (1997), Department of Fisheries and Oceans, *Pacific Salmon Treaty: Moving Towards Equity and Conservation*, paper prepared by Bud Graham, Director of Fisheries Management, Department of Fisheries and Oceans, Pacific Region.

Most of the commercial harvest of salmon occurs as the adults return to spawn, generally not directly in the rivers, but rather in marine areas where several species and stocks are intermingled. To some extent, this harvesting pattern is driven by the fact that several species deteriorate in quality as they approach their spawning streams, and thus can command higher prices if caught earlier, while they are still in mixed-stock areas (Interviews, 1998-2001)[1]. In addition, Alaskan fishery officials explain their policy of deliberately moving fishing effort into the offshore mixed stock area as helping to prevent local overharvesting while reducing monitoring and management costs (Interviews, 1998-2001). As a result of these harvesting patterns, it is inevitable that harvesters from each jurisdiction will "intercept" some of the salmon heading to spawn in the rivers of other jurisdictions. In addition, the migration patterns create distinct asymmetries by putting Alaska in a good position to intercept British Columbia's salmon while allowing B.C. harvesters to easily target many of the coho and chinook stocks heading south to the Columbia River and other U.S. west coast streams. Canada's Fraser River sockeye and pink salmon have historically been easily accessible to Washington state fishing vessels operating in the Strait of Juan de Fuca. However, the relative accessibility of those stocks to the U.S. and Canadian fleets has not been constant over time, as will be discussed below.

Pacific salmon once supported thriving Native American cultures from northern California to Alaska. When settlers poured into these regions in the late 19th and early 20th centuries, they quickly displaced the native fisheries by intercepting the returning salmon before they reached the traditional in-river fishing sites of the Native communities (American Friends Service Committee, 1970; Higgs, 1982; Glavin, 1996; Schwindt,

[1] As part of a research project funded by the U.S. National Oceanographic and Atmospheric Administration (NOAA), the author and collaborators conducted interviews with a large number of individuals who had been active in Pacific salmon management and policy, in the work of the Pacific Salmon Commission and in the negotiations leading to the 1999 Agreement. To protect the confidentiality of our respondents, material obtained from the interviews will not be tied to any specific individual in this report.

1995). The rapid growth of cummercial harvests soon threatened tu deplete salmon runs. All of the jurisdictions responded to the threat by creating agencies to regulate gear and fishing seasons. However, these authorities could never fully control harvests of the salmon stocks within their purview, because many salmon could be caught as they passed through the waters of neighboring jurisdictions on their return migration. Such "interceptions" became increasingly important over time as fishing effort expanded in offshore areas.

Commercial fisheries exploit five species of Pacific salmon: chinook *(Oncorhynchus tshawytscha)*, coho *(O. kisutch)*, sockeye *(O. nerka)*, pink *(O. gorbuscha)*, and chum *(O. keta)*. Chinook, sockeye and coho, are the most valuable species. They are currently marketed primarily as fresh or frozen fish, although there is still a substantial market for canned sockeye. Pink salmon is a low-valued species used primarily for canning, but its abundance in Southeast Alaska in recent decades has supported the development of a major fishery. All five species are harvested in Alaska, British Columbia, and Washington State, while only coho and chinook are harvested in significant numbers in Oregon and California. Harvesters employ a variety of gears, including troll lines, purse seines, and gill nets. To sume extent, these harvesting groups target different species, but sume salmon stocks encounter a gauntlet of competing gears.

Sport fisheries, primarily for cohu and chinook, have grown in the post -World War II era and now account for a sizeable share of the harvest of these species outside of Alaska (see, e.g., NPAFC, 1999). There are also minor sport harvests of pink, sockeye and chum salmon. Steelhead *(O. mykiss)* is a related species that is important to in-river sports fisheries, but it is neither commercially targeted nor significantly affected by marine fisheries, and thus is not subject to international management.

Most rivers along the Pacific coast of North America from California's Central Valley northward once supported salmon runs. Where streams have been heavily modified by human activities, some wild salmon runs have disappeared, while others have diminished. In many rivers, wild runs have been supplemented and/or supplanted by hatchery production. For example, prior to its development, the Columbia River system had been the major source of salmon south of the Canadian border. Over the course of the twentieth century, a series of dams harnessed the Columbia and its major tributary, the Snake River, to provide most of the region's hydroelectric power as well as irrigation water, flood control and navigation benefits. Natural salmon stocks in the Columbia system declined, and were partially replaced by hatchery production located in the lower part of the basin. Several Columbia Basin stocks have been listed as threatened or endangered under the U.S. Endangered Species Act, and efforts are underway to restore those populations (U.S. Federal Register, 2000). In British Columbia and Alaska, the natural variety and abundance of salmon populations is greater than in the south, and there have been fewer adverse impacts from destruction of spawning habitat.

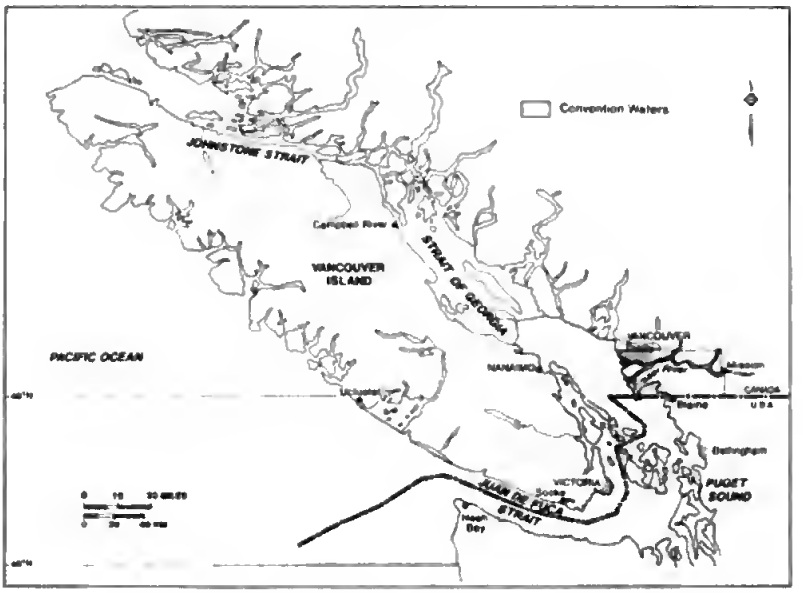
Human manipulation of the spawning environment has been a major source of change, but natural variations in both the ocean and freshwater environments also play a significant role in driving changes in salmon abundance. Long-term changes in ocean conditions have had profound impacts on the productivity and migratory behavior of several important stocks. These natural changes, together with changes caused by human activities, have altered the parties' bargaining objectives and expected payoffs from cooperation. Much of the recent turmoil in U.S. / Canadian relations over Pacific salmon management can be understood as the consequence of such changing circumstances.

HISTORY OF BI-NATIONAL COOPERATION

Canada's Fraser River system, with its abundant runs of sockeye and pink salmon, has long been a focal point of bi-national efforts to cooperate on Pacific salmon management. Although the Fraser River lies entirely in Canada, its mouth lies close to border between British Columbia and Washington State. A large portion of the salmon spawning in that system typically approach the river through the Strait of Juan de Fuca where, historically, they had been harvested by Washingtun State fishing vessels.

The Fraser River Convention, ratified in 1937, divided the harvest of Fraser River sockeye and pink salmon as well as management and restoration costs equally between the two nations (Munro and Stokes, 1989). Under the Convention, the International Pacific Salmon Fishery Commission (IPSFC) regulated harvests within an area designated as "the Convention Waters" which encompassed the traditional fishing grounds for those stocks (Roos, 1996) (Figure 2).

Figure 2



Convention waters fishing area under 1937 Convention

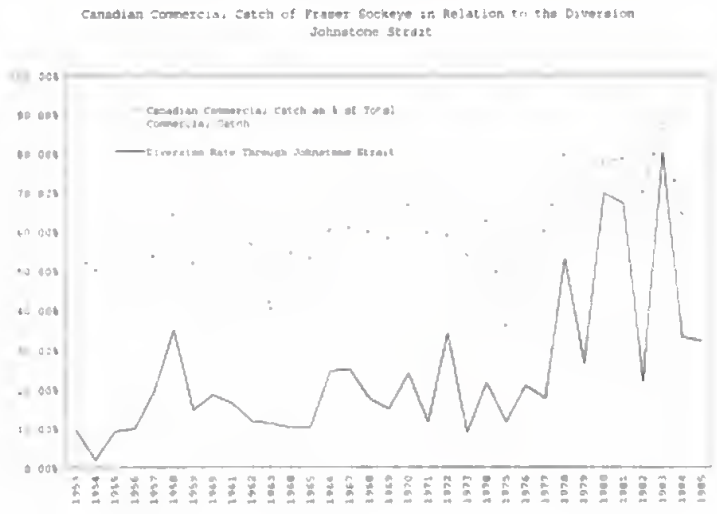
Support for the Fraser River Convention waned during the 1960s, when the Canadians became unhappy with their agreement to share one-half of the Fraser River salmon. Canadian harvesters also had discovered that they could circumvent the IPSFC regulations by fishing for Fraser sockeye in Georgia Strait, outside of the Convention waters. This was made increasingly possible and profitable by a change in the migratory habits of the returning Fraser sockeye.

As the Fraser sockeye return southward to spawn, the run splits as it rounds Canada's Vancouver Island. The (normally larger) fraction, that passes seaward of the island, must pass through the Strait of Juan de Fuca, between the U.S. and Canada. There it is accessible to harvest by both countries' fleets. The remaining fraction of the stock, returning by way of Johnstone Strait, stays shoreward of the island, entirely within Canadian waters, and accessible to the Canadian fleet outside of Convention waters (see Figure 2).

Toward the end of the Convention period, when negotiations were well underway for the subsequent Pacific Salmon Treaty (1985), a sudden shift in ocean conditions contributed to a marked increase in the average Johnstone Strait diversion rate. In the period 1953–1976, the diversion rate averaged 16.4 percent. From 1977 through 1985, the average diversion rate jumped to 46 percent.[1] This shift surely strengthened Canada's hand in the negotiations leading to the 1985 Treaty. In fact, Canada clearly took advantage of unusually high diversion rates in 1978, 1980, 1981, and 1983 to concentrate harvesting efforts outside of Convention Waters, and thus increase its overall share of the harvest (Figure 3).

[1] During the post-Treaty period, it has continued to be higher than the previous norm. The average diversion rate for 1977-1998 has been 48.2%.

Figure 3



In addition, Canadian harvesting effort intensified off the west coast of Vancouver Island, leading to increased interceptions of U.S. origin coho and chinook salmon heading south to spawn in the Columbia River system and other west coast streams. While these pressure tactics made the affected interests in Washington and Oregon eager for a settlement, Alaskans saw little potential benefit from entering into the proposed Treaty. Given the general north-to-south migration pattern for returning salmon stocks, Alaskan fisheries are in a natural position to intercept many Canadian and some southern U.S. chinook stocks, while few Alaskan stocks are vulnerable to Canadian interception. Alaska yielded only when the U.S. Treaty tribes involved in the negotiations promised that as long as the Treaty remained in force, they would not sue to extend the landmark Boldt decision[1] to restrict commercial salmon harvests in Alaskan waters[2] (Yanagida, 1987; Munro *et al.*, 1998).

The Treaty created the Pacific Salmon Commission whose primary task was to develop and recommend fishing regimes intended to govern the overall harvest and allocation of the salmon stocks jointly exploited by the U.S. and Canada. The body of the Treaty lays out a set of principles to guide the Commission in this task. Of central importance are the conservation and equity objectives or principles, which the Treaty expresses as follows:

...each Party shall conduct its fisheries and its salmon enhancement programs so as to: prevent overfishing and provide for optimum production; and provide for each Party to receive benefits equivalent to the production of salmon originating in its waters (Pacific Salmon Treaty, Article III).[3]

The Treaty then advises the Parties to consider the following factors in the application of these objectives or principles: the desirability of reducing interceptions, the desirability of avoiding disruption of existing fisheries, and annual variations in abundances of the stocks. The Treaty attempted to establish a balance among competing objectives and interests, but it failed to resolve major tensions between individual rationality and strongly held perceptions of equity.

The bargaining framework implemented in 1985 called for frequent renegotiation of the fishing regimes. Negotiations were to follow a consensus rule in that the Canadian and American delegations were to agree on new regimes. Pursuant to the U.S. legislation implementing the 1985 Treaty, the American delegation

[1] *United States v. Washington*, [W.D. Wash. 1974]. This court decision guaranteed to the Treaty tribes the right to harvest 50 percent of the salmon that would have ordinarily return to their traditional fishing grounds.
[2] Agreement between Alaska and the tribes in *Confederated Tribes and Bands v. Baldridge* (W.D. Wash. 1985).
[3] Pacific Salmon Treaty, March 18, 1985, U.S.-Can., 99 Stat. 7 [codified at 16 U.S.C. 3631-3644 (1997)].

was composed of three voting Commissioners representing Alaska, Washington/Oregon and the Treaty Indian Nations, and a fourth non-voting Commissioner from the U.S. federal government (U.S. Senate, 1985; Yanagida, 1987; Schmidt, 1996). In most circumstances, this arrangement gave each of the three voting U.S. Commissioners an effective veto over the work of the Pacific Salmon Commission in developing new regimes.

From the beginning, there were fundamental differences of opinion regarding the meaning of the so-called equity clause (Article III (1) (b)) and whether or not it should take precedence over other objectives and factors expressed in the language of the Treaty. (Shepard and Argue, 1998; McDorman, 1998a; Yanagida, 1987; Strangway and Ruckelshaus, 1998).

One major difficulty is that it is not an easy task to quantify the interceptions balance. Commercial harvest value is only one possible measure of the value of a salmon – and it is certainly not the most important measure in cases where individual stocks are threatened with extinction, support highly valued sports fisheries, or have significant cultural value to native communities that have relied on those stocks since time immemorial. Thus, while all interests recognized that the equity principle was meant to reflect economic values and did not amount to a simple fish-for-fish balancing rule, they could legitimately disagree on how the balance was to be measured. In order to reach agreement in 1985, the Parties chose to finesse the equity point by putting off any decision on measurement.[1] Their failure to firmly establish the content and role of the equity clause allowed it to become a major bone of contention when incentives to continue cooperation changed.

For the first few years, the Commission could ignore the equity issue because Canada remained satisfied that interceptions were roughly in balance. Attention focused, instead, on designing regimes that would encourage enhancement and conservation efforts by guaranteeing that the party making the investment would be able to reap the rewards from the *expected* subsequent increase in production. The regimes established by the Commission relied heavily on the use of "ceilings." For example, the initial agreement specified a cap of 7 million fish over each of two successive 4- year periods for Washington State harvest of Fraser sockeye (Pacific Salmon Treaty, Annex IV, Chapter 4*)*. This approach was based on the notion that capping harvests in the intereepting fishery would allow any increase in run strength to primarily benefit the nation of origin – whose hatchery or habitat restoration investments had presumably caused the increase.

However, while enhancement and restoration efforts certainly can increase the number of salmon available for harvest, the effects of such actions easily can be dwarfed by the impacts of natural environmental fluctuations. Negotiators on both sides underestimated the power of such natural changes, and the optimistic assumptions on which they relied proved grossly incorrect.

During the negotiation period leading to the 1985 Treaty, changes were already apparent in the ocean environment that would contribute to the Treaty's later difficulties. In the mid-1970s, ocean conditions in the North Pacific changed dramatically. Significant warming of coastal waters was reinforeed and sustained by a sequence of closely spaced ENSO (El Niño-Southern Oscillation) warm events from 1977 to 1998. Associated changes in patterns of upwelling, nutrient transport and related physical and biological processes led to favorable survival and growth conditions for salmon in the Gulf of Alaska, while survival rates plummeted for stocks that enter the marine environment along the U.S. west coast.

These climate-related changes contributed to a nearly ten-fold increase in Alaskan salmon harvests, with harvests rising from fewer than 22 million salmon (of all species) in 1974 to three successive record highs in 1993, 1994, and 1995 (Figure 4). At the 1995 peak, Alaska harvested close to 218 million salmon. Another high was attained in 1999 when Alaska harvested almost 217 million salmon.

Harvests of most salmon species in northern British Columbia fared well through the mid-1990s. However, by the late 1990s it had become apparent that many of British Columbia's southern and interior coho stocks were severely depleted (Pacific Fisheries Resource Conservation Council, 1999). In addition, British

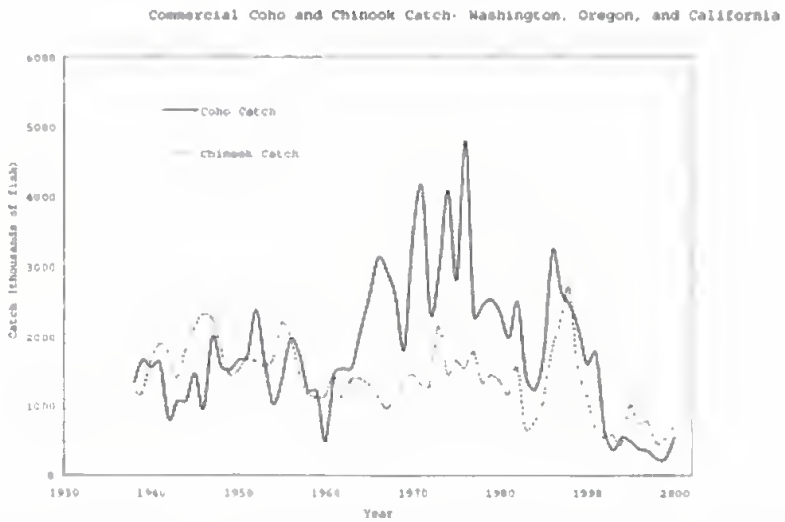
[1] Memorandum of Understanding to the Pacific Salmon Treaty: Pacific Salmon Treaty, March 18, 1985, U.S.-Can., 99 Stat. 7 [codified at 16 U.S.C. 3631-3644 (1997)].

Columbia's chinook harvests have declined steadily (Hare *et al.*, 1999; PSC Joint Chinook Technical Committee, 1999).

Southward, commercial chinook and coho catches in California, Oregon, and Washington dropped abruptly in the late 1970s, hitting El Niño-related lows in 1983 and 1984. A dramatic but brief recovery in 1986 and 1987 then gave way to a precipitous decline to record low harvests in the mid 1990s (Figure 5). Abundance declined to the point that some stocks faced a significant risk of extinction. The natural sources of low salmon survival and stock productivity in the south were compounded by other stresses, including habitat degradation, mortality at dams, water diversions, and questionable hatchery practices. By 1998 to early 1999, the cumulative effects of all of these stresses led the U.S. National Marine Fisheries Service to list a number of these stocks as "threatened" under the Endangered Species Act (U.S. Federal Register, 2000).

Figure 4

Figure 5



The explosion in salmon abundance in northern waters led Alaskan harvesters to fish harder in areas where British Columbian salmon are intermingled with Alaskan fish. In particular, the dramatic increase in pink salmon abundance in southeastern Alaska led to increased interceptions of Canadian sockeye from the

Skeena, Nass, and other northern British Columbia rivers. The Canadians proved unable to redress the growing interceptions imbalance because declining southern coho and chinook stocks prevented Canadian harvesters from reaching the agreed-upon ceilings for harvests of those stocks along the west coast of Vancouver Island. At the same time, fishing interests along the U.S. West Coast claimed that Canada's efforts to reach the ceilings resulted in overharvesting of those fragile stocks.

From Canada's perspective, there appeared to be a mounting intereeptions imbalance in favor of the U.S., but little U.S. willingness to make concessions to redress the imbalance. From Alaska's perspective, the requested concessions promised to entail only uncompensated costs. While the southern U.S. jurisdictions demonstrated a willingness to make further concessions on their harvests of Fraser River salmon in exchange for reduced Canadian harvesting pressure on southward-bound coho and chinook, they really had few bargaining chips to bring to the table.

By 1993, the growing frustrations caused cooperation to collapse when the parties proved unable to agree on a full set of fishing regimes. While clearly binding in a legal sense, the treaty-based cooperative resource management regime had nonetheless foundered, because it had not met the test of "time consistency".

The dispute festered for several years with occasional dramatic incidents, including Canada's adoption of an "aggressive fishing strategy," in 1994 (Fraser River Sockeye Public Review Board, 1995), and a three-day blockade of the Alaska Ferry by approximately 150 Canadian fishing vessels in the port of Prince Rupert in 1997. The two federal governments made several efforts to resolve the impasse, but it appears that they achieved a solution only after there was a significant shift in bargaining objectives coupled with a new-found willingness to try more flexible tools to achieve equity objectives.

Significant deterioration in the condition of Canada's fall chinook and coho stocks over this period (Pacific Fisheries Resource Conservation Council, 1999; DFO, 1998a,b) appears to have triggered a shift in Canadian bargaining objectives with respect to bi-national harvest management. The Canadian focus shifted radically from insistence on an equitable interceptions balance to the need to tailor harvesting efforts to protect the stocks that had become severely depleted. The ESA listings in the Pacific Northwest most likely colored the positions of the southern U.S. participants in the negotiations as well. This shift in focus was instrumental in breaking the previous deadlock.

Throughout 1998 and early 1999, federal negotiators from both sides worked to hammer out the details of the 1999 Pacific Salmon Agreement that was adopted on June 30. The vigor with which the two governments pursued the negotiations suggests that both sides recognized that they had much to lose if they failed to resolve their differences. The depleted condition of Canadian and southern coho and chinook stocks had caused the value of the remaining fish to increase dramatically – not as harvested fish, but as brood stock and for their contribution to symbolic, cultural and aesthetic values. It appears that fishery officials had come to the realization that the unfavorable shift in ocean conditions had substantially depressed the productive potential of these stocks, so that previous harvesting rates simply could no longer be sustained. In the end, both Canada and the southern U.S. parties made major concessions in the negotiations, while they allowed Alaska's harvests to remain relatively unchanged under the new arrangements.

Organizational Structure and Decision-Making

As noted above, under the terms of the 1985 Pacific Salmon Treaty, each nation appoints a set of Commissioners and the two sides must reach consensus on any set of proposed regimes. However, on the U.S. side, the voting Commissioners, representing Alaska, Washington -Oregon, and the 24 Treaty tribes, must first reach internal consensus for a regime to take effect. In any event, the Commission is only empowered to recommend fishing regimes to the relevant authorities. Except in the case of the Fraser River sockeye and pink fisheries, state or federal authorities retain full power to enforce fishing regulations consistent with the regimes. In the U.S., the states have authority within three nautical miles of the coast and federal jurisdiction (exercised by regional management councils) extends from 3 to 200 n. miles offshore, as well as within three nautical miles where the fisheries in question are predominantly located outside three miles. In Canada, the federal government has authority over fisheries. When the parties failed to agree on new fishing regimes, each state or federal authority would independently develop and implement its own management regime.

The Commission's organizational structure involves three geographically oriented panels. The Northern Panel focuses on stocks arising in southeastern Alaska, northern British Columbia, and the transboundary rivers. The southern panel focuses on all stocks originating south of Cape Caution in British Columbia, other than Fraser River sockeye and pink salmon, which are the purview of the Fraser River Panel. As the successor to the older International Pacific Salmon Fisheries Commission (IPSFC), the Fraser River Panel has greater powers and responsibilities than the other panels. All three panels perform the functions of reviewing post-season harvest reports, pre-season harvest management plans, and salmon enhancement programs. The Fraser River Panel also has responsibility for active in-season regulation of Fraser River sockeye and pink harvests in the area designated as Fraser River Panel Area Waters (essentially the same as the "Convention Waters" depicted in Figure 2). In addition, prior to the 1999 Amendments to the Treaty, the primary task of the panels had been to provide recommendations to the Commission for the development of fishing regimes. Information obtained from interviews with former Commissioners and Panel members suggests that much of the actual negotiation over the details of the regimes took place in the Panel meetings.

Several joint technical committees report to the Commission and its Panels. There are currently joint technical committees for chinook, coho, chum, data sharing, and selective fishery evaluation. In addition, geographically focused technical committees provide analyses for the Fraser River, northern boundary, and transboundary areas (PSC, 2002). There had formerly been a Joint Interceptions Committee. Its few reports tended to document the wide range of uncertainty surrounding the estimates and the disparate views of the parties as to the magnitude and direction of interceptions imbalances (PSC-JIC, 1993). That committee ceased issuing reports when the dispute over equitable allocation escalated.

Procedural transparency has never been a hallmark of U.S./Canadian negotiations over Pacific salmon management. This observation applies equally to the pre-Treaty period, the activities of the Pacific Salmon Commission and its Panels and to the government-to-government negotiations leading to the new agreement. For example, it appears that some of the Canadian participants in the negotiations leading up to the 1985 Treaty were taken by surprise when the U.S. instituted the internal consensus rule embodied in the subsequent U.S. implementing legislation (U.S. Senate, 1985; Interviews, 1998-2001). That rule put the Canadian side at a distinct disadvantage and proved to be a significant barrier to compromise in the work of the Commission.

Schmidt (1996) characterizes the rule as formally turning the negotiation process into a "two-level game" in which the U.S. side had to first solve an internal benefit allocation game before negotiating with Canada. Although the Canadian federal government exercised final control over Canadian positions in the negotiations, there was some evidence of such two-level processes on the Canadian side, as well. For example, in our interviews with Canadian fisheries officials, more than one respondent noted that it took many years of concerted effort to convince all of the B.C. fishing interests that coho exploitation rates were too high and needed to be reduced. Efforts by Canadian fishery officials to accommodate competition across harvesting groups kept coho harvest rates high until the late 1990s, to the detriment of both Canadian and U.S. stocks, ultimately requiring more drastic policy adjustments (Interviews, 1998-2001).

During the Treaty period, most of the meetings of the Pacific Salmon Commission and its Panels have not been open to the public. Prior to the 1999 Agreement, our interview respondents indicated that the Commission meetings tended to be large, and overly formal. They also reported that true dialog was hindered by the fact that each side would come to meetings with rigid, pre-set positions that had been worked out in internal national caucuses. This approach made it very difficult for the parties to negotiate compromises.

In the course of the struggle to find a solution to the crisis that prevailed from 1993 through 1998, the two national governments engaged in high-level negotiations, to which the members of the Pacific Salmon Commission were not privy (Interviews, 1998-2001). Early in the dispute, the national governments also invited a neutral third-party diplomat, Christopher Beebe of New Zealand, to act as a mediator (Reuters, 1995). His non-binding recommendations were to be kept secret if rejected by either side. The U.S. rejected his 1996 report, but an unknown party leaked its "secret" contents (favoring Canada's position on the equity dispute) to the region's newspapers (Westneat, 1997). That development only served to further inflame the quarrel. Following the failed mediation effort, the two governments experimented with a stakeholder

process in which fishing interests on both sides of the border met to discuss options. They also commissioned a joint report by two eminent individuals from each nation, David Strangway of Canada and William Ruckelshaus of the U.S., on the sources of the dispute and potential remedies. The Strangway and Ruckelshaus Report concluded that both sides would need to make concessions in order to restore cooperation, and that the Parties should concentrate their efforts on developing a "practical framework for implementing Article III of the treaty [the Principles Article] leading to the establishment of longer-term fishing arrangements."[1] The Report also advised the governments to terminate the stalemated stakeholder process and to undertake a comprehensive review of the Pacific Salmon Commission to make it "a functional institution for the preservation and management of the Pacific Salmon."[2]

The two national governments then intensified their high-level negotiations (largely by-passing the Commission and the various stakeholder groups), and eventually concluded the 1999 Agreement. It appears that the national governments deliberately eschewed "transparency" during the final stages of the negotiation process. This may have been necessary to escape the traps into which the Commission's negotiations had fallen. As one interview respondent put it, "Broad participation can have a downside" (Interviews, 1998-2001).

However, the approach created considerable disappointment among the excluded Commissioners and stakeholders, and some expressed feelings that the process left them with little sense of "ownership" in the outcome (Interviews, 1998-2001). This was particularly true on the Canadian side, where major changes in domestic salmon harvest policies, to move salmon to sport and aboriginal fisheries and to protect weak stocks, had been implemented while the negotiations were in progress. The simultaneous loss in harvesting opportunities, and in access to the decision process, left some of the affected Canadian interests feeling disenfranchised (Interviews, 1998-2001).

Changes Introduced by the 1999 Agreement

The 1999 Agreement does not replace the 1985 Pacific Salmon Treaty, but rather places additional obligations on the Parties and replaces the expired short-term harvest management regimes, contained in an annex to the Treaty, with new longer-term arrangements (McDorman, 1998b; U.S. Department of State, 1999). In reaching the agreement, the two nations consented to temporarily set aside the dispute about equitable division of the harvest and to focus on implementing multi-year abundance-based harvesting regimes that would foster conservation and restoration of depressed salmon stocks. Rather than relying on short-lived, ceiling-based regimes whose frequent renegotiation provided ample opportunity for disagreement and brinkmanship, the new agreement establishes a long-term commitment to define harvest shares as a function of the abundance of each salmon species in the areas covered by the Treaty. For example, for 12 years beginning in 1999, the U.S. share of Fraser River sockeye will be fixed at 16.5 percent of the TAC (total allowable catch). This represents a decrease from the post-1985 average U.S. share of 20.5 percent, but an increase relative to the share actually attained by the U.S. fleet during the 1992–1997 salmon war period (DFO, 1999; O'Neil, 1999).

The new arrangements for chinook, which will be in effect for ten years, take account of the fact that the various fisheries along the coast differ considerably in the extent to which they rely on healthy or depressed chinook stocks (U.S. Department of State, 1999). Accordingly, the agreement designates two types of fisheries: 1) abundance-based management (AABM) fisheries will be managed based on indices of the aggregate abundance of chinook present in the fishery, without specific reference to any individual stock; 2) individual stock-based management (ISBM) fisheries, which are primarily located in fishing areas near the spawning rivers, will be managed based on the status of individual stocks or groups of stocks (e.g., on the basis of the evolving status of currently endangered or threatened stocks).

In accordance with this change in approach, the major work of the Commission has shifted from negotiating the terms of new management regimes to implementing the terms of the current long-term abundance-based

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[1] Strangeway and Ruckelshaus, 1998, p. 8.
[2] *Id.* at p. 8.

regimes, and developing similar regimes for those stocks for which abundance-based regimes had not been worked out at the time of the signing of the 1999 Agreement. The Commission also defines its current mission to include improving scientific cooperation, and supervising joint efforts to assist the recovery of weak stocks, (PSC, 2002).

A major feature of the agreement is its provision for two endowment funds. Initial funding is to be provided entirely by the U.S., but either Party may make additional contributions, and even third parties may contribute, with the agreement of the two states. The annual investment earnings on the Northern Boundary and Transboundary Rivers Restoration and Enhancement Fund (Northern Fund), and Southern Boundary Restoration and Enhancement Fund (Southern Fund) are to be used to support scientific research, habitat restoration and enhancement of wild stock production in their respective areas. The U.S. agreed to contribute $75 million to the Northern Fund and $65 million to the Southern Fund over a four-year period. The first installments have been made, and balance of the commitment is to be remitted in fiscal year 2003. Canada also contributed $250,000 (CND) to each of the two funds in November 2000 (PSC, 2002). Since the funds (at this stage) come overwhelmingly from the U.S., they can be viewed as implicit side payments from the U.S. to Canada. The funds, together with new U.S. federally funded vessel buyback programs and significant additional U.S. federal funding for salmon habitat restoration efforts (PSC, 2002), also constitute side payments from U.S. taxpayers to salmon harvesters.[1] To date, there has not been a sufficient yield from the endowment funds to finance any significant projects. In fact, the funds have incurred substantial losses as a result of recent stock market declines (Interviews, 2002). So, it will be some time before their potential can be realized.

PROGRESS AND PROSPECTS

The 1999 Agreement represents a significant step forward. The shift in focus toward conservation represents a broadening in the scope for bargaining, while the abundance-based management formulas still accommodate Alaska's strong interest in the commercial harvesting sector. Abundance-based management is better suited than the ceiling approach to maintaining appropriate levels of harvesting effort when there are large natural changes in salmon abundance. In addition, the experimental use of side payments in the form of the endowment funds opens the door for a more flexible approach to allocating the benefits of these fisheries.

Although these developments are laudable, the new agreement has not laid all sources of conflict to rest. A particular weakness is the fact that effective implementation of abundance-based management requires that the parties agree on the indices of abundance that will be used to set their harvest targets. Abundance, however, is very difficult to forecast in advance of the arrival of the runs. Forecasting models are imperfect, and data inadequacies and the uncertain and uneven impacts of variable marine and river conditions impair the accuracy of the forecasts. Precise estimates are likely to remain an elusive goal. The best that reasonably can be expected should be mutual willingness to accommodate uncertainty and to share the risks arising from imprecise abundance estimates. However, the new agreement leaves the Commission's institutions for decision-making largely intact, and has not dealt directly with the problem of unstable incentives to cooperate. Thus, scientific uncertainties may loom larger than ever as a source of conflict (McDorman, 1998b). One of the most pressing needs will be to find a way around this problem.

Already, there have been some disagreements between Alaska and the Chinook Technical Committee (CTC) regarding the abundance estimates to be applied in determining allowable chinook harvests (ADF&G, 2000). The abundance estimates generated by the CTC's chinook model are very sensitive to the data used to calibrate the model, and when a recalibration alters the abundance indices, catch limits are to be adjusted accordingly.[2] In 2000, Alaskan officials disputed the results of a recalibration that would have called for significant reductions in Alaskan harvests. Efforts are under way to re-assess and improve the forecasting model. However, for chinook, as for all of the other salmon species, the ability to forecast abundance and

[1] On December 15, 2000, the U.S. Congress authorized full payment of the $150 million committed to the Endowment Funds plus $30 million for a vessel buy-back program and up to another $100 million per year for coastal restoration (PCS, 2002).

[2] U.S. - Canada Agreement Relating to the Pacific Salmon Treaty, June 30, 1999, Annex IV, at Chapter 3, section 6.

the stock composition of the fish harvested in any particular area is hampered by data inadequacies and by the uncertain and uneven impacts of variable marine and river conditions.

Despite these difficulties, the CTC model stands out as a good example of the advantages of scientific cooperation. Work on the CTC model began in the pre-1985 Treaty period. The model was subsequently refined, and continues to be improved. It allows the Treaty participants to work with a common, formal representation of a highly complex system. The model forces them to make their assumptions explicit, and allows each to replicate the results obtained by the others. While the model is not transparent to members of the general public, the professionals can use it to mutually explore the implications of any given set of assumptions. Some interview respondents voiced the opinion that shared, jointly-developed models and assessment methodologies are critical to fostering a common understanding of the state of the resource and the potential consequences of alternative management actions (Interviews, 1999; 2002).

The 1999 Agreement called for replacing the former Committee on Research and Statistics with a new Committee on Scientific Cooperation. In January 2001, the Commission adopted Terms of Reference for the new committee (reiterating the wording of the 1999 Agreement) and in February, 2001 each country appointed two scientists to serve on the committee (Agreement, 1999, Attachment D; PSC, 2002). At present writing, it is too early to evaluate its influence or effectiveness.

The need to come to agreement on measures of abundance is not the only challenge that lies ahead. The new agreement calls for the development of abundance based regimes for all relevant stocks. However, in some cases, the scientific information that would be needed to develop robust long-term regimes simply does not exist. For example the development of abundance-based regimes for coho stocks proved to be particularly difficult and time-consuming. The 1999 Agreement directed the Parties to "... develop and implement, beginning in 2000 and extending through 2008, an abundance-based coho management regime for Washington and southern British Columbia fisheries" (Agreement, 1999, Annex IV Chapter 5, para. 5). However, the 2000 starting date proved to be unrealistic, and it took until early 2002 for the two sides to develop a workable abundance-based approach for coho. A major reason for the delay was the fact that Canada had not actively managed its own coho stocks until very recently, and thus lacks much of the data that would be desirable for the design of long-term abundance-based regimes. Nevertheless, the parties have now agreed to a management system that defines maximum exploitation rates and sharing formulas for each of several "coho management units" which are groups of individual populations with similar characteristics. There are schedules relating the maximum exploitation rates and national shares to the current status of the unit as defined by its placement into one of three stock-status categories (Interviews, September 2002). The arrangements also specify sanctions that will come into force in the event of harvests exceeding the applicable ceilings. In addition, scientists from both nations are cooperating to develop a formal Southern Panel area coho management model to facilitate joint analysis of the impacts of harvesting on these stocks.

Cooperative management of coho harvests in the northern area has been hampered by differing assessments of the status of those stocks and causes for the decline of some of Canada's interior coho stocks (PSC-TCNB, 2002). For example, Alaskan scientists attributed the major decline of Canada's Babine coho stock after 1978 to an abrupt drop in carrying capacity associated with Canada's expanded sockeye enhancement program in that system, while Canadian scientists linked the declines to increased exploitation (PSC- TCNB, 2002). In addition, most of Alaska's coho stocks are healthy and able to withstand higher exploitation rates than some of the intermingled B.C. stocks. While most of Alaska's coho do not have to traverse long distances in the freshwater to spawn, many of the weaker B.C. stocks spawn far inland and consequently have lower inherent productivity due to in-river mortality. So for northern coho, divergent conservation versus harvest goals still present challenges to effective joint management.

There is language in the new regimes for the Transboundary Rivers and Northern Boundary area that is intended to clarify accounting of the harvest balance and its relationship to domestic conservation measures.[1] The Northern Boundary regime calls for cumulative accounting and payback of "overages" and "underages"– with balances to be carried forward in the event of failure to renew the regime at its expiration. The Transboundary Rivers regime further specifies that "if a shortfall in the actual catch of a party is caused by the management action of that Party, no compensation shall be made" (Agreement, 1999, Annex IV,

[1] U.S. - Canada Agreement Relating to the Pacific Salmon Treaty, June 30, 1999, Annex IV, Chapters 1 and

Ch.1, para. 4). This particular provision appears to address Alaskan charges that part of the alleged interceptions imbalance had been due to inept Canadian efforts to manage Canadian harvests of weak stocks intermingled with abundant stocks.

LESSONS FROM OTHER FISHERIES

In the Pacific salmon case, one of the most pressing needs will be to keep disagreements about the abundance estimates from turning into crippling disputes. In that regard, Canada and the U.S. could look to the Russian/Norwegian cooperative framework in the Barents Sea for guidance. There, an independent scientific organization ICES (the International Council for the Exploration of the Sea) facilitates bilateral scientific cooperation (Stokke, *et al.* 1999; Munro, 2000). The two nations actively contribute to the research efforts of this multinational organization. While each nation also conducts independent fisheries research, they coordinate their activities bilaterally and through ICES, and rely on the ICES Advisory Committee on Fishery Management for stock assessments and recommendations regarding harvest levels and practices. The author understands that the Barents Sea case will be presented at this Expert Consultation.

ICES provides scientific information and advice in support of other international fishery agreements as well, notably in the Baltic and North Atlantic. Its broad base and independence from direct government control allow the recommendations coming from ICES to be viewed as credible and impartial. The independence of the ICES Advisory Committee is the factor that most clearly differentiates it from the newly appointed Standing Committee on Scientific Cooperation under the Pacific Salmon Commission.

There is a similar independent scientific organization in the Pacific – PICES (the North Pacific Marine Science Organization). It is a much younger organization than ICES,[1] that has not yet assumed a prominent role in providing scientific advice to fishery managers, but it is serving to coordinate international research efforts on such topics as atmosphere—ocean—ecosystem interactions and specifically the ocean ecology of salmon populations. It seems possible that PICES could grow into the role of an independent (and neutral) provider of timely management-oriented stock assessments, if the Parties to the Pacific Salmon Treaty were willing to encourage and finance that development. At the very least, the engagement of such an organization in the ongoing assessment efforts of the Commission and the relevant fishery agencies could serve to enhance transparency and to curtail unproductive disagreements about abundance indicators.

Experience in other fisheries also suggests that Canada and the U.S. could potentially go much further in their use of side payments to promote an equitable balance of benefits and to improve the efficiency of harvesting and restoration efforts. Given falling prices for commercially harvested salmon and the high cost of current efforts to restore ailing salmon populations in Puget Sound, along the Oregon coast and in the Columbia Basin, opportunities may exist to use additional side payments to further reduce harvesting pressures on sensitive stocks (Shaffer and Associates Ltd., 1998). For example, we might envision payments from U.S. Pacific Northwest power, forestry, water-use, and development interests to compensate Canadian (and perhaps Alaskan) harvesters for further reducing harvests of the threatened and endangered stocks.

The efforts of the Iceland-based and largely privately supported North Atlantic Salmon Fund (NASF) to reduce ocean harvesting of Atlantic salmon provides a model. Since 1991, NASF has worked in collaboration with other organizations to increase the number of Atlantic salmon returning to their natal streams by paying commercial Atlantic salmon harvesters in the Faroe Islands not to fish their allocated quota. Similarly, in both 1993 and 1994, the NASF reached a comparable agreement with the commercial salmon harvesters of Greenland. In February, 2002, NASF also collaborated with the government of U.K. to buy out English drift net licenses along the British east coast, with the goal of increasing the number of salmon returning to Scotland's east coast rivers (IntraFish Bulletin, 2002). In addition, NASF was instrumental in convincing the Irish government to institute district-based quotas to reduce Irish commercial salmon harvests (NASF, 2002)

Recently, NASF and the North-American based Atlantic Salmon Federation (ASF), with financial support from the U.S. Department of Interior and Department of State concluded a five-year agreement with KNAPK (the commercial harvester's organization in Greenland) that terminates all commercial salmon fishing by the

[1] PICES is only 10 years old, while ICES is close to 100 years old.

Greenland fleet and allows only a limited annual subsistence harvest. In exchange, Greenland's harvesters will receive financial support for the development of alternative fisheries (ASF, 2002). This deal was precipitated by the fact that the North Atlantic Salmon Conservation Organization (NASCO) which is the international regional fisheries organization that governs commercial harvests of North Atlantic Salmon, had allocated a quota of 55 tonnes (20,000 salmon) to the Greenland fleet for the year 2002, despite an ICES recommendation that the quota be set at zero to protect imperiled North American and Southern European salmon stocks. The situation replicates an interesting dynamic that has developed between NASCO and NASF over the past several years whereby NASCO has granted quota allocations that conservation interests view as dangerously high, leaving NASF and its collaborators to scurry to gather funding to buy out the allocations. While some observers view the situation as evidence of a dysfunctional conflict (World Wildlife Fund, 2002), it could alternatively be viewed as accommodating Greenland's individual rationality position while allowing for efficient closures of those fisheries.

North America's Pacific salmon fisheries also could draw lessons from abroad on the subject of optimizing the location of harvesting effort. The Russian/Norwegian Mutual Access Agreement (1976) governing their Barents Sea fisheries for Arcto-Norwegian cod – along with haddock and capelin, provides an example of the use of an access agreement to rationalize the management of a bi-national fishery. In that case, the cod migrating between the Russian and Norwegian zones spend their juvenile life stages in the former zone, and their adult life stages in the latter zone. It makes good sense for the cod to be harvested as adults, and the agreement has allowed the Russians to take a substantial portion of their cod quota in the Norwegian zone (Stokke *et al.*, 1999).

In the North American Pacific salmon case, a cross-border access agreement could be used to prevent accumulation of imbalances in harvests relative to the agreed-upon formulas. For example, if an imbalance in favor of the U.S. were to accumulate in a specific fishery, the U.S. national government could acquire existing transferable fishing licenses and rent them to Canadian fishing vessels. Those vessels could then use the licenses to fish in U.S. waters, with their harvests credited to the Canadian "account".

CONCLUSION

The current management arrangements for Pacific salmon are not perfect, and much could be learned from the experiences of other fisheries. Nevertheless, the 1999 Agreement represents a significant effort to come to grips with some of the major sources of instability in previous efforts to cooperate. In particular, the new long-term abundance-based approach reflects an increased appreciation of the need to make harvesting arrangements responsive to variations in stock abundance, while avoiding the costly and uncertain process of frequent renegotiations. As such, it serves to maintain time consistency. However, possible disagreements over abundance estimates have not been eliminated.

Ongoing efforts to enhance scientific cooperation and to further develop and refine joint management models should help to reduce the scope for such disagreements. The success of these collaborative efforts will depend importantly on the provision of adequate financial support and on the engagement of a community of credible and impartial scientists in these efforts.
In addition, the introduction of side payments, in the form of contributions to the endowment funds, enhances the flexibility of the agreement and may allow it to better accommodate the inherent asymmetries among the parties to the agreement. Such side payments provide another avenue for achieving an equitable balance of the benefits of these fisheries when an acceptable balance cannot be achieved through harvests alone. The full potential of this approach is yet to be realized and it remains unclear if the endowment funds, as currently conceived, will yield sufficient returns to make a difference.

Finally, it appears that the two nations have given voice to a broader range of interests in the management of their shared salmon resources. The new focus on conservation responds to long-standing requests by environmentalists, sport, and Native American/First Nations groups in both nations to reduce commercial harvests of weak stocks to allow them to rebuild to healthy levels.

Just as the Parties to the Pacific Salmon Treaty could learn from experiences in other fisheries, their experiences also can provide lessons. Chief among these is the critical importance of providing flexibility to respond to changing circumstances, and to do so in such a way that all parties perceive real gains from

continued cooperation. Side payments can be a valuable tool in this regard. Another important lesson is the value of common scientific understandings regarding the status of shared resources. In the Pacific Salmon case, divergent views on stock status contributed to past conflicts, while increasing scientific consensus has been an important factor in recent progress.

REFERENCES

ADF&G (Alaska Department of Fish and Game), 2000. *Statement of Work Improving the Pacific Salmon Commission's Chinook Model Abundance Index*, available on World Wide Web, Oct. 2000, at: wysiwyg://34/http://www.state.ak.us/adfg/geninfo/special/recovery/chinkmdl.htm.

American Friends Service Committee, 1970. *Uncommon Controversy: Fishing Rights of the Muckleshoot, Puyallup and Nisqually Indians*. University of Washington Press, Seattle. 232 pp.

ASF (Atlantic Salmon Federation), 2002. Press Release: "Greenland to Help Save the Wild Salmon of Europe and North America." Aug. 19, 2002.
http://www.asf.ca/Communications/2002/aug/greenland.html.

Burke, W., 1991. "Anadromous Species and the New International Law of the Sea", *Ocean Development and International Law* 22: 95-131.
DFO (Department of Fisheries and Oceans, Government of Canada),1998a. Canada's Coho Recovery Plan, *Backgrounder*, June 1998.
http//www.dfo-mpo.gc.ca/communic/backgroun/1998/1906_e2.htm

DFO (Department of Fisheries and Oceans, Government of Canada),1998b. The Pacific Salmon Fishery: A 15-Year Perspective, *Backgrounder*, June 1998.
http//www.dfo-mpo.gc.ca/communic/backgroun/1998/1906_e9.htm

DFO (Department of Fisheries and Oceans, Government of Canada),1999. Canada and U.S. reach a comprehensive agreement under the Pacific Salmon Treaty, *Press Release, and Backgrounders*, June 3.
http:// www.ncr.dfo.ca/
Fraser River Sockeye Public Review Board, 1995. *Fraser River Sockeye 1994: Problems and Discrepancies*. Canada Communication Group - Publishing, Ottawa.

Glavin, 1996. *Dead Reckoning: Confronting the Crisis in Pacific Fisheries*. Greystone Books, Vancouver, B.C., 181 pp.

Hare, S. R., N. J. Mantua and R. C. Francis, 1999. Inverse Production Regimes: Alaska and West Coast Pacific Salmon. *Fisheries*, 24(1): 6-14.

Higgs, R., 1982. Legally-Induced Technical Regress in the Washington Salmon Fishery, *Research in Economic History*, 7(1): 55-86.

Huppert, Daniel D., 1995. *Why the Pacific Salmon Treaty Failed to End the Salmon Wars*, School of Marine Affairs, University of Washington, SMA 95-1, Seattle.

IntraFish Bulletin, 2002. "English fishermen offered compensation to save wild salmon stocks," Feb. 12, 2002.

McDorman, T. L., 1998a. A Canadian View of the Canada-United States Pacific Salmon Treaty: The International Legal Context (I), *Willamette Journal of International Law and Dispute Resolution* 6: 79-98.

McDorman, T. L., 1998b. A Canadian View of the 1999 Canada-United States Pacific Salmon Agreement: A Positive Turning Point? (II) *Willamette Journal of International Law and Dispute Resolution* 6: 99-112.
Miller, K., G. Munro, T. McDorman, R. McKelvey, and P. Tydemers, 2001. "The 1999 Pacific Salmon Agreement: A Sustainable Solution?" *Occasional Papers: Canadian-American Public Policy*, No. 47, Canadian-American Center, University of Maine, Orono.

Munro, G.R., 2000. On the Economic Management of "Shared Fishery Resources," in A. Hatcher and D. Tingley (eds.), *International Relations and the Common Fisheries Policy*, Portsmouth, Centre for the Economics and Management of Aquatic Resources, University of Portsmouth, 149-167.

Munro, G. R. and R. L. Stokes, 1989. "The Canada-United States Pacific Salmon Treaty," in D. McRae and G. Munro, (eds.), *Canadian Oceans Policy: National Strategies and the New Law of the Sea*, University of British Columbia Press, Vancouver, 17-35.

Munro, G. R., T. McDorman and R. McKelvey, 1998. Transboundary fishery resources and the Canada-United States Pacific Salmon Treaty, *Occasional Papers: Canadian - American Public Policy*, No. 33, Canadian - American Center, University of Maine, Orono.

NASF (North Atlantic Salmon Fund), 2002. Press Release: "Ireland's Government Surrenders. NASF scores its biggest victory yet in its battle to save the wild Atlantic salmon," January 11, 2002.

NPFAC (North Pacific Anadromous Fish Commission, 1999. *Statistical Yearbook, 1995.* Vancouver, B.C.

O'Neil, P., 1999, Taking stock of the Salmon Treaty, *Vancouver Sun*, July 5, Final ed., A1.

Pacific Fisheries Resource Conservation Council, 1999. *1998-1999 Annual Report.* PFRCC, Vancouver, B.C.

Pearcy, W. G., 1992. *Ocean Ecology of North Pacific Salmonids.* Univ. of Washington Press, Seattle.

PSC (Pacific Salmon Commission), 2002. 2000/2001 Sixteenth Annual Report. Pacific Salmon Commission, Vancouver, B.C.

PSC-JCTC (Pacific Salmon Commission - Joint Chinook Technical Committee), 1999. *Preliminary Retrospective Analysis of the U.S. and Canadian Proposals for Abundance-based Regimes for Chinook Fisheries.* TCCHINOOK (99)-1. Pacific Salmon Commission, Vancouver, B.C.

PSC- JIC (Pacific Salmon Commission – Joint Interceptions Committee), 1993. *Third Report on the Parties' Estimates of Salmon Interceptions – 1980-1991.* Report JIC (93)-1. Pacific Salmon Commission, Vancouver, B.C.

PSC-TCNB (Pacific Salmon Commission – Northern Boundary Technical Committee), 2002. *Status of Coho Salmon Stocks and Fisheries in the Northern Boundary Area.* Report TCNB (02)-3, July 2002, Pacific Salmon Commission, Vancouver, B.C.

Reuters, 1995. Salmon Talks to get Mediator New Zealand Diplomat to Tackle U.S., Canadian Stalemate, *Seattle Times*. August 26, Final ed., A8.

Roos, J. E., 1996. *Restoring Fraser River Salmon: A History of the International Pacific Salmon Fisheries Commission 1937-1985.* Pacific Salmon Commission, Vancouver, B.C.

Schmidt, R. J., Jr., 1996. International negotiations paralyzed by domestic politics: two-level game theory and the problem of the Pacific Salmon Commission, *Environmental Law* 26: 95-139.

Schwindt, R., 1995. "The Case for an Expanded Indian Salmon Fishery: Efficiency, Fairness, and History," in H. Drost, B. L. Crowley and R. Schwindt (eds.), *Market Solutions for Native Poverty.* Renouf Publishing Co. Ltd., Ottawa, 98-152.

Shepard, M. P., and A.W. Argue, 1998. Ocean Pasturage in the Pacific Salmon Treaty Fact or Fiction? Canadian Industry Report of Fisheries and Aquatic Science 242. Department of Fisheries and Oceans Canada, Vancouver, B.C.

Stokke, O. S., L. G. Anderson and N. Mirovitskaya, 1999. "The Barents Sea Fisheries," in O. Young (ed.), *The Effectiveness of International Environmental Regimes: Causal Connections and Behavioral Mechanisms.* The MIT Press, Cambridge, MA, 91-154.

Strangway, D. W. and W. D. Ruckelshaus, 1998. *Pacific Salmon: Report to the Prime Minister of Canada and the President of the United States.* January 12.

United Nations, 1982. United Nations Convention on the Law of the Sea. UN Doc. A/Conf. 62/122.
U. S. Department of State, 1999. *Diplomatic Note No. 0225 from Canada to the United States; reply; attached Agreement.* June 30.

U.S. Federal Register, 2000. Department of Commerce, National Oceanic and Atmospheric Administration, 50 CFR Part 223 (Docket No. 991207323-9323-01; I.D. No. 092199A) RIN 0648-AM59. *Endangered and Threatened Species; Proposed Rule Governing Take of Seven Threatened Evolutionarily Significant Units (ESUs) of West Coast Salmonids: Oregon Coast Coho; Puget Sound, Lower Columbia and Upper Willamette Chinook; Hood Canal Summer-run and Columbia River Chum; and Ozette Lake Sockeye.* Federal Register, Vol. 65, No. 1, Monday January 3, 2000, Proposed Rules, pp. 170-196.

U.S. Senate, 1985. Pacific Salmon Treaty Act of 1985, Pub. Law no. 99-5, 99 Stat. 7.

Westneat, D., 1997. Secret fishing report sides with Canada, *The Seattle Times*. May 31, Final ed., A1.

World Wildlife Fund, 2002. Press Release: "U.S. Agrees to Harvest of Endangered Atlantic Salmon: Announcement Made After Decision to Bar Media" June 7, 2002. http://www.worldwildlife.org/news/headline.cfm?newsid=362.

Yanagida, J. A., 1987. The Pacific Salmon Treaty. *The American Journal of International Law*, 81: 577-592.

COOPERATIVE FISHERIES MANAGEMENT ISSUES IN THE BALTIC SEA

by

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Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and the Belts

The Convention was issued to protect the living resources of the Baltic Sea and the Belts and to accomplish their rational utilization by a close cooperation between the Contracting Parties of the Convention.
The Convention covers:

- all waters of the Baltic Sea and the Belts (excluding internal waters)*
- all fish species and other living marine resources in the Convention Area

INTERNATIONAL BALTIC SEA FISHERY COMMISSION

The International Baltic Sea Fishery Commission was established pursuant to Article V of the Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and the Belts (The Gdansk Convention) which was signed on the 13 September 1973 by Governments of the Baltic States (Denmark, Finland, German Democratic Republic, Federal Republic of Germany, Poland, Sweden, Soviet Union).

The pattern of membership of the Commission changed following the accession of the European Economic Community to the Convention on the 18th March 1984, with the simultaneous withdrawal of Denmark and the Federal Republic of Germany.

The unification of Germany in 1990 reduced the number of Contracting Parties to five. In 1992, Estonia, Latvia and Lithuania acceded to the Convention.

Finland and Sweden became members of the European Community on the 1st of January 1995.

There are now six Contracting Parties:

Estonia, the European Community (EC), Latvia, Lithuania, Poland and the Russian Federation.

DUTIES OF THE COMMISSION

The duties of the Commission are, among others:

- to coordinate the management of the living resources in the Convention Area, and
- to prepare and submit recommendations based as far as practicable on results of scientific research for consideration of the Contracting Parties

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* The catch reporting also includes catches taken in internal maritime waters

Article X of the Convention:

"Measures relating to the purposes of this Convention which the Commission may consider and in regard of which it may take recommendations to the Contracting States are:

a) any measures for the regulation of fishing gear, appliances and catching methods,
b) any measures regulating the size limits of fish that may be retained on board vessels or landed, exposed or offered for sale,
c) any measures establishing closed seasons,
d) any measures establishing closed areas,
e) any measures improving and increasing the living marine resources, including artificial reproduction and transplantation of fish and other organisms,
f) any measures establishing total allowable catch or fishing effort according to species, stocks, areas and fishing periods including total allowable catches for areas under the fisheries jurisdiction of Contracting States.
g) any other measures related to the conservation and rational exploitation of the living marine resources."

When taking its decisions the Commission takes into account:
- the need to protect the stocks and
- the need to minimize the economic dislocations in the fishing communities of the Contracting Parties.

The enforcement of the measures adopted by the Commission lies with the Contracting Parties in their respective Fishery Zones.

In 1974 the Commission started its practical work by establishing technical regulatory measures such as mesh opening regulations, minimum landing sizes by species, by-catch provisions etc.

In the meantime a whole system of regulatory measures has become effective.

This includes Total Allowable Catches (TACs) for Herring, Sprat, Cod and Salmon for the whole Baltic and by Fishery Zones.

When TACs were first established by the International Baltic Sea Fishery Commission (IBSFC) in the mid 1970s the Coastal States had access to all fishing grounds of the Baltic Sea. **Later following the close of the III UN Law of the Sea Conference and the establishment of national Fishery Zones covering the whole Baltic Sea the allocations had to be made under new legal conditions.** Several considerations played a role in determining the specific allocations (historical catches, aerial distribution of fish stocks and fishing dependent areas etc.) but in the very beginning there were no clear rules or parameters for reference. However, factors extraneous to fisheries did not figure in the allocation process. For the last few years, the allocations for the Contracting Parties have been based on fixed percentages for the individual species (Cod, Herring, Sprat and Salmon) by countries.

Total Allowable Catches (TACs) established by the IBSFC for the respective years in thousand tonnes (*):

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Herring				422	444 •	405 •	420•	419 •	445•	475 •	475•
Sprat				275 •	184 •	161 •	81 •	60 •	48•	48 •	58•
Cod				185	174 •	175	235	227			
Salmon											

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Herring	480•	490•	490 •	490•	490 •	483 •	486 •	486 •	650 •	650 •
Sprat	85 •	105•	117 •	117 •	142•	150 •	163•	290 •	415 •	700 •
Cod					220 •	211•	171 •	100 •	40 •	60 •
Salmon				3.0	3.5		3.8 •	4.0 •	3.8 •	3.6

	1995	1996	1997	1998	1999	2000	2001	2002			
Herring	670•	670 •	670 •	670•	570•	490•	372	260			
Sprat	500•	500•	550•	550•	468•	400•	355	380•			
Cod	120•	165•	180•	145•	126•	105•	105•	76•			
Salmon	620•	570•	520•	520•	510•	540•	520•	510•			

*) **blank spaee** means no TAC (TACs) established or agreed upon;
numbers given show the TAC for the whole Baltic unanimously adopted by the Commission
• means the TAC for the whole Baltic was split into TACs by Fishery Zones unanimously adopted by the Members of the Commission
The Salmon TACs have been established from 1995 onward by number of fish in thousands.

The table indicates that from the beginning (1977) it was possible to agree upon the Baltic Sea TACs for the pelagic species - Herring and Sprat - and their shares by Fishery Zones of the Coastal States. It also indicates that it was very difficult to agree on Cod and Salmon - the economically more important species.

In case of Cod it was even not possible to agree on a Baltic TAC for the years 1982- 1988.

Concerning Salmon it was not before 1991 - 17 years after the establishment of the Commission - that an agreement was reached on a Baltic TAC and an allocation scheme.

From 1991 onward the Commission was in a position to unanimously agree on the TACs for all main species and the allocations by Fishery Zones (with the exemption of objections made concerning Herring and Sprat in 2001 and 2002).

The Commission agreed upon fixed distribution keys for the distribution of TACs between the IBSFC Contracting Parties.

This is illustrated by the tables for 1999 and 2002.

Distribution of TACs between IBSFC Contracting Parties

Year 1999

	Cod 22-29 + 32		Herring 22-29S+32		Herring 29N,30,31		Sprat 22-32		Salmon 22-31		Salmon 32	
Total TAC	**126 000 tonnes**		**476 000 tonnes**		**94 000 tonnes**		**468 000 tonnes**		**410 000 specimen**		**100 000 specimen**	
	%	**Quota**	**%**	**Quota**	**%**	**Quota**	**%**	**Quota**	**%**	**Quota**	**%**	**Quota**
Estonia	1.78	**2 243**	10.14	**48 270**	0.00	**0**	10.30	**48 210**	2.066	**8 471**	9.300	**9 300**
EC	60.90	**76 734**	54.95	**261 560**	100.0	**94 000**	36.28	**169 790**	75.417	**309 210**	81.400	**81 400**
Latvia	6.77	**8 530**	6.86	**32 650**	0.00	**0**	12.44	**58 220**	12.930	**53 013**	0.00	**0**
Lithuania	4.45	**5 607**	2.14	**10 190**	0.00	**0**	4.50	**21 060**	1.520	**6 232**	0.00	**0**
Poland	21.10	**26 586**	20.14	**95 870**	0.00	**0**	26.40	**123 550**	6.167	**25 285**	0.00	**0**
Russia	5.00	**6 300**	5.77	**27 460**	0.00	**0**	10.08	**47 170**	1.900	**7 790**	9.300	**9 300**
Total	**100.0**	**126 000**	**100.0**	**476 000**	**100.0**	**94 000**	**100.0**	**468 000**	**100.0**	**410 000**	**100.0**	**100 000**

Distribution of TACs between IBSFC Contracting Parties

Year 2002

	Cod 22-29 + 32		Herring 22-29S+32		Herring 29N,30,31		Sprat 22-32		Salmon 22-31		Salmon 32	
Total TAC	76 000 tonnes		200 000 tonnes		60 000 tonnes		380 000 tonnes		450 000 specimen		60 000 specimen	
	%	Quota	%	Quota	%	Quota	%	Quota	%	Quota	%	Quota
Estonia	1.78	**1 353**	10.14	**20 280**	0.00	**0**	10.30	**39 140**	2.066	**9 297**	9.300	**5 580**
EC	60.90	**46 284**	54.95	**109 900**	100.0	**60 000**	36.28	**137 860**	75.417	**339 377**	81.400	**48 840**
Latvia	6.77	**5 145**	6.86	**13 720**	0.00	**0**	12.44	**47 270**	12.930	**58 185**	0.00	**0**
Lithuania	4.45	**3 382**	2.14	**4 280**	0.00	**0**	4.50	**17 100**	1.520	**6 840**	0.00	**0**
Poland	21.10	**16 036**	20.14	**40 280**	0.00	**0**	26.40	**100 320**	6.167	**27 751**	0.00	**0**
Russia	5.00	**3 800**	5.77	**11 540**	0.00	**0**	10.08	**38 310**	1.900	**8 550**	9.300	**5 580**
Total	**100.0**	**76 000**	**100.0**	**200 000**	**100.0**	**60 000**	**100.0**	**380 000**	**100.0**	**450 000**	**100.0**	**60 000**

Taking into account the specific interests of the Contracting Parties in certain species and fisheries transfers of quota and/or reciprocal access arrangements have become a normal procedure on a bilateral basis. It was noted that, when transfers of quota are made among members (or reciprocal access arrangements), these transfers a5re not permanent (for one respective year only) and that they are normally exchanged for quota for other species subject to IBSFC management. There have, however, been instances of quota being exchanged in return for development assistance payments.

The transfers of quotas are illustrated in the table for 1999 indicating as an example the Herring transfers.

Every year the Commission analyses the utilisation of the Baltic TACs of the preceding year taking note of the quota transfers (gained from/granted to other Parties) and the available catch for the respective parties (see table for the utilisation of Herring in year 2001).

Rule 2.1

Quota transfers and exchanges of quotas between Contracting Parties according to new Rule 2.1 of the Fishery Rules of the IBSFC in tonnes *:
Species: Herring1999

Contracting Party	Allocated quota	gained from		granted to		Available quota
		Contracting Party	tonnes	Contracting Party	tonnes	
Estonia	48 270			EC	3 000	45 270
EC	261 560	Estonia Lithuania Poland	3 000 1 800 1 000	Poland Russia	4 000 3 000	260 360
Latvia	32 650					32 650
Lithuania	10 190			EC	1 800	8 390
Poland	95 870	EC	4 000	EC	1 000	98 870
Russia	27 460	EC	3 000			30 460

* **These data refer to the Main Basin and the Gulf of Finland (Recommendation No 2) Herring in Management Unit III (Recommendation No 1) is not included**

Report on the utilization of the Baltic TACs established by the IBSFC for 2001
HERRING

	IBSFC	Transfers				Available catch of each Contracting Party	Tot. catch in 2001	The part of catch taken in the zones of other Contracting parties or in other areas		Balance Excess (+) or Deficit (-) to available catch of each Contracting Party	Overall catches in the zone of the Contracting Parties				Balance Exeess (+) or Deficit (-) to IBSFC TACs
		gained from		granted to others				zone of/or the other area	catch in tonnes		by the Contracting Party	by others		Total	
		Contracting Party	Weight	Contracting Party	Weight							Contracting Party	Weight		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Management Unit III	72 000					72 000	70 721			-1 279	70 721			70 721	-1 279
Estonia	30 420 (41 070) [1]					30 420 (41 070) [1]	41 738			+11 318 (+668) [1]	41 738			41 738	+11 318 (+668) [1]
European Community	164 850	Lithuania Poland	2 500 1 000	Poland Latvia	4 000 3 000	161 350	147 792	Lithuania	166	-13 558	147 626	Poland	3 837	151 463	-13 387
Latvia	20 580	EC Poland	3 000 4 000			27 580	26 652			-928	26 652			26 652	+6 072 [2]
Lithuania	6 420			EC	2 500	3 920	1 639			-2 281	1 639	EC	166	1 805	-4 615
Poland	60 420	EC	4 000	EC Latvia	1 000 4 000	59 420	37 611	EC	3 837	-21 809	33 774			33 774	-26 646
Russian Federation	17 310					17 310	15 797			-1 513	15 797			15 797	-1 513
TOTAL	372 000		14 500		14 500	372 000	341 950		4 003	-30 050	337 947		4 003	341 950	-30 050

1) Objection made to IBSFC TAC; national decision
2) This is no overfishing, because EC and Poland transferred Herring (together 7,000 tonnes) to be fished in Latvian waters

Since 1994 the IBSFC has taken steps to limit the effects of IUU fishing. Measures include national authorization of vessels allowed to fish Cod in the Convention Area, monthly catch reporting, landing reports where landings are made in ports of other Contracting Parties and since 2001, joint inspection schemes.
This process has led to a new IBSFC Fishery Rule which is now **Rule 2**:

"**2.1** With a view to achieve a better utilization of existing fishing possibilities of the fish stocks subject to regulations agreed by the Baltic Commission, transfers can be made between Contracting Parties.

Contracting Parties shall not later than 1 February inform the Commission of quota transfers and exchanges of quotas with other Contracting Parties or third countries. Contracting Parties shall inform the Commission on any other quota transfers or quota exchanges during the year not later than one month after the transaction.

Vessels flying a flag other than the one of the Contracting Party in whose waters they are fishing, outside a fisheries agreement between Contracting Parties or with a third country, shall have a specific authorization for a defined fishing activity from the official authorities of that Contracting Party and the flag state. The relevant authorities of the Authorizing Contracting Party under whose quota the fishing shall take place shall, prior to the commencement of the fishery, communicate to the IBSFC Secretariat the conditions under which this fishery can take place, specifying:

- the species
- the quantities in live weight
- the period of the fisheries
- the name(s) of the vessel(s)

A reference to the written authorization must be made in the logbook. When landing the catch the written authorization to fish in that Contracting Party's zone must be shown on request to the competent control authorities.

A Contracting Party shall not later than 1 February provide the Commission with a list of vessels authorized to fish Cod in the Baltic Sea under its quota.

Contracting Parties shall inform the Commission on any changes to the list not later than 3 days before the changes to the list become effective.
The Commission shall circulate any such information received to all Contracting Parties without delay.

2.2 Contracting Parties shall for species managed by IBSFC TACs, provide the Commission with monthly catch statistics broken down by Fishery Zone and Management Area for fishing by their own vessels. Communication of these statistics shall take place at the latest on the last day of each month for the preceding month.

2.3 Contracting Parties shall, through the relevant authorities, provide other Contracting Parties with monthly statistics broken down by vessel, Fishery Zone, Management Area and species managed by IBSFC TACs for landings by vessels from the relevant Contracting Party, including landing of catches obtained under arrangements outside fisheries agreements between the Contracting Parties or with a third country.

Contracting Parties shall provide the Commission with monthly statistics on landings of other Contracting Parties, broken down by Fishery Zone and species managed by IBSFC TACs.
Communication of these statistics shall take place at the latest on the last day of each month for the preceding month.
A Contracting Party shall also refuse landings of Cod which have been transshipped.

2.4 The Commission shall circulate information received under 2.1 to 2.3 to the Contracting Parties at the latest by the seventh day of the following month.

A Contracting Party shall refuse landings of vessels from other Contracting Parties of species of which the relevant national quota is exhausted."

The control of landings in ports of other Contracting Parties is illustrated by the table "Monthly statistics of landings of other Contracting Parties in 1998 as received by the IBSFC Secretariat".

Monthly statistics of landings of other Contracting Parties in 1998
as received by the IBSFC Secretariat

Landings of Cod - Cumulative January- June

Reporting Party	January	February	March	April	May	June	July	August	September	October	November	December
EC	369.1*	643.1*	713.3*	1 306.5*	2 432.8*	2 536.1*						
Estonia												
Latvia												
Lithuania	8.6**	19.3*	54.7**	69.9**	70.9**	79.7**						
Poland												
Russia												
TOTAL	377.7	662.4	768.0	1 376.4	2 503.7	2 615.8						

* from the Zones of all Contracting Parties (see Annex)
** from Russian Zone

Landings: Herring, Sprat and Salmon - Cumulative January – June

- **Estonia** reported landings of **Herring** : **470 tonnes** landed by EC (Finnish vessels) from the EC Fishery Zone
- **Estonia** reported landings of **Sprat**: **1,993 tonnes** landed by EC (Finnish vessels) from the EC Fishery Zone;
- **EC** reported landings of **Sprat 12,707 tonnes** (**4,720 tonnes** by Poland from Polish Fishery Zone, **7,987 tonnes** by Danish vessels on private arrangements from Polish Fishery Zone)
- **EC** reported landings of **Salmon: 221 fish (99 fish** by Latvia from Latvian Fishery Zone, **122 fish** by Poland from the Polish Fishery Zone).

In addition, there have been **21 tonnes of Sprat** landed by **Faroe** vessels on private arrangements from **the Estonian Zone**.

CASE STUDY OF SMALL PELAGIC FISH RESOURCES IN NORTHWEST AFRICA

by

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Note: Some sections of this paper contain summaries from the reports of the FAO working group on the assessment of small pelagic fish off Northwest Africa and the Workshop on the management of shared small pelagic fishery resources in Northwest Africa organized by FAO and the Nansen Programme.

Résumé:

Les eaux marines de la région nord ouest africaine sont très productives en raison d'un upwelling actif. Le secteur de la pêche joue un rôle prépondérant dans l'économie des différents pays. En dépit de leur faible valeur marchande, les poissons pélagiques côtiers sont les espèces dominantes dans les captures et constituent les ressources les plus abondantes et les mieux partagées. Leur exploitation concerne aussi bien le secteur industriel que le secteur artisanal.

Ces espèces font l'objet d'évaluations régulières et les mesures d'aménagement préconisées indiquent un suivi strict de l'effort dans les pêcheries de chinchards et de maquereaux. Un taux de capture à ne pas dépasser a été défini pour les sardinelles.

Les influences respectives de la pêche et des fluctuations de l'environnement sur l'abondance de ces stocks ne sont pas bien comprises. En effet, l'abondance des stocks pélagiques reste tributaire des conditions hydroclimatiques et ces stocks nécessitent par conséquent une gestion qui tienne compte de leur instabilité.

Les pays consentent actuellement un effort dans le sens de mieux réglementer la pêcherie. Mais faute de moyens et de coopération plus poussée, le respect des mesures édictées ne donne pas encore pleine satisfaction. Des initiatives récentes sont prises pour sensibiliser sur la nécessité d'un aménagement concerté de ces stocks partagés.

Abstract:

The marine waters off Northwest Africa are very productive because of the active upwelling that takes place at different intensities along the coast and which supports important fish resources (among which the small pelagics are the most abundant). The fishery sector plays an important role in the economies of the different countries of the region. Despite their relatively low commercial value, the pelagic fish are dominating the catches and is important to both the industrial and artisanal sectors.

Several assessment studies of these resources have been carried out, and the management recommendations given calls for a control of effort in the mackerel and horsemackerel fisheries, whereas a catch level not to be exceeded has been defined for sardinella.

The pelagic stock abundance is highly sensitive to changes in hydro-climatic conditions; however the influence of fishing and environmental factors on the abundance of these stocks is not well understood and hence requires a management that takes this into account.

The countries of the region have agreed to put into place measures to better control their fisheries. However, due to a lack of funding and insufficient regional cooperation on this issue, the measures are not yet satisfactory. Recently, there have been some initiatives to promote better management of shared stocks.

INTRODUCTION

The coastal countries of the northern part of the Eastern-Central Atlantic region (from Morocco to Guinea, including the Cape Verde islands) constitute a geographical entity with a population of about 50 million inhabitants, most of whom live in the coastal area. The Exclusive Economic Zone (EEZ) of the region covers about 2 475 000 km².

The waters of the sub-region can be divided into three zones: the northern zone comprising Morocco, Mauritania, Senegal and the Gambia that is characterized by a well-defined upwelling rich in nutrients; the Guinea-Bissau to Guinea zone that is influenced by numerous estuarine contributions; and the island zone of Cape Verde with a reduced continental shelf and very little upwelling.

The existence of favourable hydrological conditions, notably the Canary and Guinea currents, allow the development of a rich marine fauna that are exploited by national vessels as well as by vessels from outside the region.

This document describes some of the pelagic resources, the respective fisheries and some of the management measures that are in place in the northern zone mentioned above. It also describes recent initiatives concerning management of shared stocks, and attempts to present a perspective of how a concerted effort can be made for the management of the coastal pelagic stocks in this area.

BACKGROUND

For most of the countries in Northwest Africa, fish is the only source of animal protein for the majority of the population. The fish consumption of about 20 kg/year/inhabitant surpasses the average for the rest of Africa, which is 8.2 kg/year/inhabitant.

The fishery sector employs thousands of people, and contributes on average to more than 4.3 percent of the GDP of these countries. In Mauritania the fishery sector contributes to about 12 percent of the GDP. The sector also contributes to the countries' earnings through the various fishing arrangements, agreements and licenses. The fishing agreements provide the states with financial compensations and other support measures, such as institutional support and training of nationals. However, it can be noted that the basic principle of these agreements, that is "to exploit the surplus production that the national fleets are not utilizing" does not relate well to the observed decline and even collapse of certain fish stocks and with the inaccuracy of the scientific data in some countries which were used to quantify these quotas (IUCN, 1999).

The important marine resources of the sub-region, notably the small pelagics that can constitute in weight close to 70 percent of the total landings of these countries were for many years exploited mainly by foreign vessels but with significant catches taken by the traditional Senegalese pirogue fishery. With the ratification of the Convention of the Law of the Sea and the extension of the EEZ to 200 miles, the possibility for the coastal states to exploit these resources increased. The coastal states quickly became aware that the revenue drawn from the exploitation could only last if the resources were rationally exploited. They also recognized that fisheries management is a complex problem that poses difficulties at different levels (conceptual, political, social and administrative) because of the various biological, technological, socio-economic, environmental and institutional aspects that must be considered and integrated simultaneously. Conscious of this problem, and in particular of the difficulty to reconcile the conservation of biodiversity, the respective environmental conventions and the exploitation of resources with the aim to improve the economic situation, the authorities of the different countries have tried to define national strategies for the management of the fishery resources and biodiversity. However it must be admitted that the measurements taken up to today regarding stock management have not prevented the decline of some stocks and the possible degradation of the ecosystems and problems of overcapacity, which continue to feed the polemics over the fishing agreements and which is a cause of concern for the fishery sector as a whole.

The aim of this case study is to examine the possibilities for the setting up of a concerted effort at the sub-regional level to ensure the effective cooperative management of the shared small pelagic resources. While a cooperative management system is currently not in place for the sustainable exploitation of shared stocks in this sub-region there is increasing cooperation in the region in various management related functions including stock assessment, monitoring, control and surveillance and access agreements with third countries.

DESCRIPTION OF RESOURCES

The small pelagic fishes constitute the bulk (tonnage) of all fish landings and are the most important marine resources in the waters of the coastal countries within the study area (SAMB, B and B. C. Dioh, 1996). Due to their migratory nature, the small pelagics are shared by all these countries. Annual averages of several years indicate that the small pelagics can reach 70 percent of the declared catches.

The small pelagic resources comprise the following families: clupeidae, carangidae, engraulidae and scombridae.

The Clupeidae consists mainly of the sardinellas (*Sardinella aurita* and *Sardinella maderensis*) and the sardine (*Sardina pilchardus*) that are found in abundance in West Africa. *Sardinella aurita* (round sardinella) is concentrated in areas of cold water whereas *Sardinella maderensis* (flat sardinella) prefers lower salinity areas, often close to the river mouth. Two other species worth mentioning are the West African ilisha (*Ilisha africana)* and the bonga shad (*Ethmalosa fimbriata*) that live in estuaries and coastal zones

Two of the most important species belonging to the group Carangidae are *Trachurus trachurus* and *Trachurus trecae* that live mainly between 25 °S and 19° N. Species of *Trachurus* form very dense schools that can be fished using a trawl with a big vertical opening down to 200 meters depth. The false scad (*Caranx rhonchus*) is distributed from Guinea to Dahla as northern boundary with important catches between April to July.

The group Engraulidae is represented by different species of which the most common is the anchovy (*Engraulis encrasicholus*).

The chub mackerel (*Scomber japonicus)* , which belong to the family Scombridae, is found along the entire West African coast.

Some of the secondary species caught in the coastal pelagic fisheries include: the Bigeye grunt (*Brachydeuterus auritus*), the Atlantic bumper (*Chloroscombrus chrysurus*), and the hairtails (*Trichiurus lepturus*). The sompat grunt (*Pomadasys jubelini*) shows strong abundance especially in the transition season and remains a target for fisheries.

DESCRIPTION OF FISHERIES

The artisanal and industrial fisheries exploit the small pelagic resources. The artisanal fishing is carried with motorized and non motorized canoes using different types of fishing gears. The industrial fishing involves the use of trawlers and purse seiners. Some of these are foreign vessels operating through fishing agreements.

Among the exploited pelagic stocks, the sardinellas and horse mackerel are shared by Morocco, Mauritania, Senegal and Gambia. The presence of the sardine is especially localized in Morocco and in Mauritania. Therefore only the sardinellas and horse mackerel will be studied within the scope of this document.

The reference documentation for this chapter include the reports of the FAO working group on the assessment of small pelagic fish off Northwest Africa (FAO, 2001; FAO 2002a), working documents prepared for the Workshop on the management of shared small pelagic fishery resources in Northwest Africa held in Banjul, the Gambia 30 April-3 May 2002 (FAO, 2002b; FAO, 2002c; FAO, 2002d; FAO, 2002e) and FAO Fisheries Report 636 (Caramelo *et al.*, 2001).

Sardinella

The two species of sardinella are generally caught together. The round sardinella is normally targeted by the different fisheries due to its higher commercial value and because of its higher abundance in this sub-region. Figure 1 presents the evolution of the total catches of sardinella in the whole zone between 1990 and 2001. From the figure it can be seen that the trends of the two species are fairly similar. The largest catch of round sardinella registered was in 1998 with nearly 450 000 tonnes caught. Since then there has been a steady decrease in the landings of this species whereas the catch of the flat sardinella show an increasing trend in the same period. The catches of *Sardinella aurita* and *Sardinella maderensis* in 2001 were about 300 000 tonnes and 130 000 tonnes respectively (FAO, 2002c).

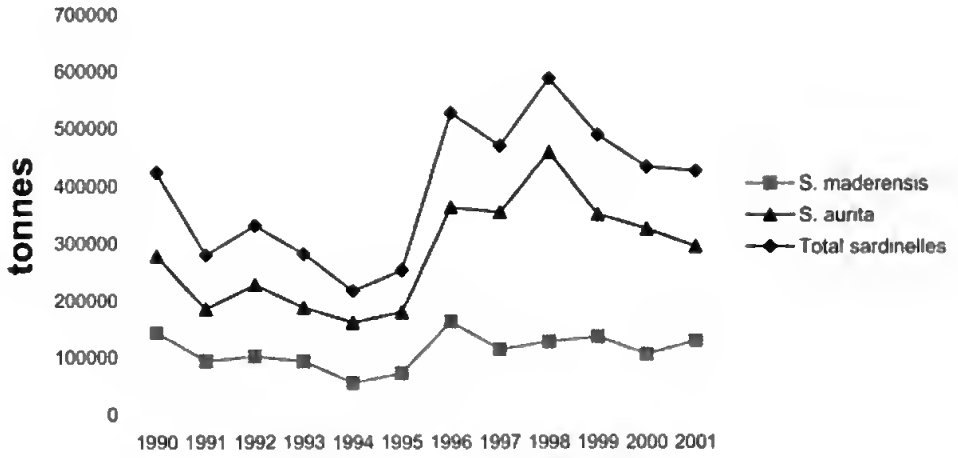

Figure 1: Catches of sardinella in Northwest Africa (from FAO, 2002c, unpublished)

The fisheries

In Senegal sardinella is caught by both the artisanal and the industrial fishery. The largest landings are by the artisanal fishery, which is constantly developing. This is carried out in motorised canoes with diverse fishing gear such as purse-seine, gillnets and beach seine. The industrial fleet is made up of small purse seiners or small tonnage sardine boats "sardiniers Dakarois" and powerful foreign vessels. The number of "sardiniers Dakarois" has been in continual decline for a number of years. In 2001 and 2002, only five were still fishing. During the eighties and nineties, large tonnage purse seiners and Russian trawlers fished in the Senegalese EEZ. The purse seiners disappeared in 1994 and the pelagic trawlers in June 1999 with the stop of the fishery agreement [why have they disappeared?], hence today the Senegalese industrial fishery is made up entirely of "sardiniers Dakarois".

Sardinellas in Mauritania are caught mostly by pelagic vessels from the European Union and in particular from the Netherlands. In 1999 the number of EU vessels were 13 (FAO, 2001). The fleet grew by two large vessels in 2000 and in 2001 another vessel arrived resulting in a substantial increase in the fishing effort of this fleet.

In the area between Dakhla and Cape Blanc the fishery became important at the beginning of the nineties. It is mainly carried out by pelagic trawlers chartered by Morocean professionals and those vessels operating under the fishing agreement between Morocco and the Russian Federation. During the last five years (1997-2001) the fleet has declined from 35 to 22 fishing vessels. The highest yields of sardinella by this fleet were between the months of July and October in the area between Cape Barbas (22°N) and Cape Blanc (19°40'N). During 2000 and 2001, only the chartered trawlers operated in this zone. The Russian fleet stopped fishing at the end of 1999 following the expiry of the fishing agreement.

In the Gambia, small pelagic fish, including sardinellas have not been targeted by the artisanal and industrial fleets since 1991. Consequently landings are very low.

Horse mackerel

The evolution of catches of the three species of horse mackerel between 1990 and 2001 is shown in figure 2. The total catches of these species in the sub-region were about 290 000 tonnes in 2001. The total catches seem stable over the time period, with some fluctuations. The Cunene horse mackerel (*Trachurus trecae)* is the most important species in the landings in this time period, with a catch in 2001 of close to 200 000 tonnes. The catches of this species fluctuate in most of the time period, showing an increasing trend from 1999-2001. The catches of the Atlantic horse mackerel (*Trachurus trachurus)* show a slight increasing trend up to 1998, followed by a decrease in recent year. The catches of *Caranx rhonchus* are fairly stable for most of the period, with an increase from 1998-2000.

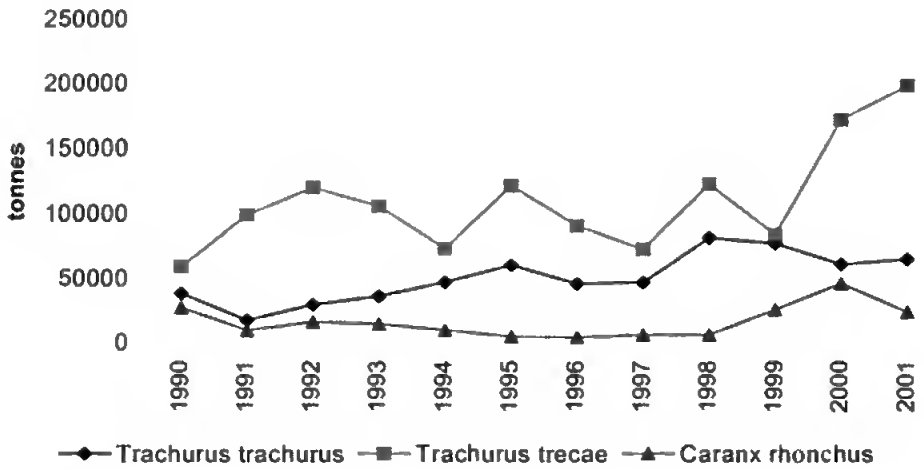

Figure 2: Catches of horse mackerel off Northwest Africa 1990-2001 (from FAO, 2002d, unpublished)

The fisheries

In Mauritania, the fleets are composed of long range trawlers, which follow the concentrations of fish and process the catch (freezing, canning, fish-meal). These fleets are made up of vessels from Eastern Europe that have been in the zone for four decades, and more recently of European Union vessels. The national industrial fleet is not very developed (FAO, 2002d).

In Senegal, horse mackerel does not constitute a significant part of the catch. Over the last few years the largest catches have been recorded by Russian vessels operating offshore (FAO, 2001).

In the Moroccan Northern zone, the Atlantic horse mackerel (*Trachurus trachurus*) is fished by a national fleet composed of purse seiners and coastal trawlers. The purse seiners target mainly sardine, whereas the trawlers target mainly cephalopods and demersal species (FAO, 2001).

In the area between Dakhla and Cape Blanc horsemackerel is exploited by the pelagic trawlers described above in the chapter on sardinella.

The European Union trawlers are from the Netherlands and Ireland and target sardinella mainly.

Management recommendations

The second meeting of the FAO Working Group on the assessment of small pelagic fish off Northwest Africa that met in Banjul, The Gambia in April 2002 formulated the following management recommendations for sardinella and horse mackerel (from FAO, 2002a):

For the sardinellas, the working group recommends to maintain the level of catches at 500 000 tons for the two species combined in the total area. It should be noted that the total catches in the region is below the recommended 500 000 tons for the last three years, despite a substantial increase in fishing effort of the EU industrial fleet in Mauritania.

The annual catches of the different species of horse mackerel have fluctuated strongly over time, but all species show an increasing trend from 1990 to 2001. The CPUE data, calculated for vessels that targeted horse mackerel, show a declining trend. Moreover, the acoustic estimates of R/V Dr. Fridtjof Nansen show a decreasing trend for both species of *Trachurus*. This decline is partly compensated by the increase in biomass of false scad.

Considering the many uncertainties in the assessment of these stocks, a precautionary approach should be taken in management of the stocks. For this reason, the WG recommends a restriction of fishing effort to the current level.

PRESENT STATUS OF MANAGEMENT

At present the assessment of the small pelagic resources are made at the sub-regional level through the FAO Working Group on the assessment of small pelagic fish off Northwest Africa. This excellent cooperation between scientists of the sub-region is the first stage for a concerted management of these resources.

Management measures are however adopted at the national level and one country's measures do not always correspond to management schemes applied in the neighbouring countries.

Management measures adopted by each of the member countries are summarized below.

Facing signs of over-exploitation of most fisheries resources of the Moroccan EEZ, management measures have heen formulated and put into place. Below are the management measures applied: (i) freezing of fishing effort to the present level by an embargo on investments; (ii) control of foreign effort with respect to fishing agreements; (iii) restriction/banning of fishing within the 3, 6, 12 and 15 nautical miles contours depending on fishery; (iv) the setting up of a catch monitoring system by placing scientific observers onboard foreign vessels and the setting up of a Commission to control landing size of octopuses; (v) the strengthening of surveillance systems by the acquisition of planes and the possible utilization of satellites; and (vi) the introduction of a closed season in 1989 ("repos biologique") in certain fisheries, extended in 1992 to all fisheries.

In Mauritania, the management of fisheries is currently based on regulation of fishing effort, the delineation of fishing zones and closing of the fisheries (enacted every year). For example, in line with the recommendation of CECAF, fishing effort has been reduced by 40 percent in the fishery of mackerels and horse mackerel. Fishery research has been intensified, particularly research on the small pelagics exploited by the artisanal fleet. Since the 1st of January 1995, access to resources by the artisanal fisheries is subjected to the remittance of symbolic royalties ("territorial right") by canoe and by year.

For the industrial fishery in Mauritania, the adopted management measures comprise the following: (i) the banning of imports of nets having a stretched mesh size of less than 70 mm; (ii) the revision of the fisheries legislation in conformity with the United Nation Convention on the Law of the Sea that entered into force November 16, 1994; (iii) the launching, since September 1994, of an international "call for sale" of licenses for the pelagic fishery; and (vi) for MCS, the creation of the "Delegation of the surveillance and control at sea" which is a civilian and autonomous entity, in replacement of the existing ministerial structure.

Gambia has adopted and put into place the following management measures: (i) delineation of fishing zones for artisanal and industrial fishing activities. Access to the area within 7 and 12 miles of the coast is restricted for vessels above 250 GRT (ii) A MCS unit has been created and patrolling/policing is carried out by the Gambian Navy. Two patrol boats are being used, complemented by a plane provided under the Luxembourg development project (Project symbol)

In Senegal, the access to the fisheries has been limited by the means of a system that varies according to the resource being exploited. The global fishing effort now increases more slowly than in the past and a close monitoring of the artisanal fishing effort has been suggested. Access of industrial fishing vessels to the coastal zone exploited by canoes has been restricted. It has been recommended to limit the fishing effort to the level observed in 1992. A concerted approach for fisheries management, calling on contributions from research and professionals (industrial, fisher-artisans, etc.) has been formulated and its implementation is done through the advice of local and regional management "councils"[1].

From the above review, it is clear that the management measures in place in the four countries are based mainly on zonation, minimum size with respect to certain species, mesh-size regulations, protection of certain species, licensing systems and the fisheries closures. In general, the legislations in force prohibit some types of fishing, forbids fishing for marine mammals and the use of explosives, poisonous substances and the use of electric discharges as a fishing method. The obligation to embark observers and to declare catches is a general measure in all countries. Surveillance projects working in close collaboration with a regional project based in the Gambia are in place.

The different legislations in place bear witness of the countries' commitment to the conservation and sustainable exploitation of their fisheries resources. However, it is at present appropriate to proceed to develop a mechanism for the concerted management of shared stocks.

NEED FOR COOPERATIVE MANAGEMENT

The countries of the sub-region aspire to a sustainable development in terms of creation of national wealth and social progress, conservation of the resources and the long-term sustainability of its exploitation. Recognizing that each country alone cannot solve the problems related to the management and sustainable development of the shared resources, the first initiatives to cooperation and coordination were started by some countries in the mid 1970's. The first meetings between the fisheries administrations in the region aimed at, among others, the harmonization of policies as regards fishing activities in the sub-region, the adoption of a common strategy towards international processes, the encouragement of the creation of common fisheries associations and the establishment of fishing agreements between certain countries of the region (SAMB, B. and H.O. EJIWEN, 1997). It was these concerted efforts that led to the creation of the Sub-Regional Fisheries Commission (SRFC). Under the auspices of this Organization the member states have agreed on the following conventions:

- Convention for the determination of access conditions and exploitation of resources off the coasts of the Member States of the SRFC (1993)

This convention determines the access conditions applicable to all vessels operating in the ZEEs of the member countries. The application of the convention is at present only partial, but nevertheless constitutes an important element for the development of a common fishing policy for the sub-region. It also gives perspectives to operators so that they are submitted to the same legal rules in all member states.

- Convention on the sub-regional cooperation regarding the exercise of hot pursuit (1993)

This convention establishes principles of cooperation between "the state pursuing" and "the state sheltering" regarding the inspection of fishing vessels in infringement and establishes criteria for the distribution of expenses concurred during operations. The convention makes a distinction between vessels carrying the flag of SRFC Member States and vessels of other flag states.

[1] "conseils de pêches régionaux et locaux"

- Protocol on the coordination of surveillance activities

The protocol foresees a certain number of cooperative activities in surveillance for the countries of the sub-region: Joint operations, exchange of information, improvement of communications, training etc.

Despite the cooperative effort described above, no agreement oriented specifically towards shared stocks exists as of today. It is only from 2001, that the possibility of establishing some sort of a joint management mechanism for the shared stocks has been explored by the countries of the sub-region. To this effect, workshops have been organized by various organizations encouraged by the WWF (Kees, L. *et al.*, 2002) and recently a Workshop organized by FAO and the Nansen Programme (FAO, 2002b).

The importance of collaboration to ensure sustainable management of shared stocks is a major topic in international fishery policy and the Law of the Sea. It constitutes the "raison d'être" for the 1995 United Nations Fish Stocks Agreement relating to highly migratory and straddling stocks. In the same way, the need for a shared authority is the fundamental principle of the Sub-Regional Fisheries Commission. Unfortunately, this principle is not currently reflected in the access agreements to the fishing zones of the region. In contrary, agreements are negotiated individually by the countries and the cumulative effects on the shared stocks are not taken adequately into account. One of the important points to note here is perhaps the absence of regional cooperation as regards access control of foreign fleets.

OPTIONS FOR A COOPERATIVE MANAGEMENT REGIME

Issues related to the management of shared stocks were examined at a Workshop held in Banjul, The Gambia in April/May 2002. The Workshop was organized by FAO with the support of the Nansen Programme (FAO, 2002b). Scientists, administrators and lawyers working in the fisheries sector participated in this workshop.

Papers describing experiences from the North Sea were presented as well as documents analyzing the situation of fisheries and management organizations of the sub-region. The Workshop also proposed some options for the concerted management of the small pelagic fish stocks.

One of the background documents prepared for the above workshop (Owen, 2002) proposed, after an in-depth analysis, the following two options (from Owen, 2002):

The first is for the four States (Morocco, Mauritania, Gambia and Senegal) in question to form an arrangement among themselves. The justification for this would be that (a) it would allow focus on the unit of principal interest to the Fridtjof Nansen Programme for Northwest Africa and (b) it would allow negotiation between the four States from first principles. It need not be a treaty; on the contrary a MOU or joint statement among the States might be more appropriate.

Its chief disadvantage is that it would ignore the significant cooperation arrangements already in place. Further, it would potentially need to be integrated with any existing bilateral arrangements existing between any of the four States in question (e.g. the arrangements between The Gambia/Senegal, Mauritania/Senegal, Morocco/Senegal, and Morocco/Mauritania).

The second broad option would instead be to use any of the existing arrangements. However, use of such arrangements would require (as appropriate):

(a) accession to the African Atlantic Convention by The Gambia and Mauritania coupled with an amendment of the existing system of consultative mechanisms and introduction of a sub-regional approach ; or

(b) a means of linking Morocco into the activities of the SRFC coupled with an amendment of the existing system of consultative mechanisms; or

(c) strengthening of the position of CECAF coupled with introduction of a sub-regional approach.

The Workshop participants did not favour the idea of creating a new organization, and noted the difficulties of determining a total TAC on an annual basis and its distribution/allocation among the countries. It was recognized that the examples given from the North Sea are the results of decades of cooperation and that the countries of Northwest Africa are in the process of capacity building. For reasons of simplicity and because the degree of complexity of management measures is likely to be progressive, it was felt that a new organization was not needed at the current time. Rather the country representatives participating in the high level management group should have the appropriate qualifications as well as the authority to endorse, or appropriately amend, the management options recommended by the scientific working group. A scientist and a representative of the fishing industry should also attend the management group as part of the country delegation. partnership with the Nansen Programme.

The following recommendations indicated in annexe were formulated to support in medium term the process of establishing a functional mechanism for cooperation later to be adopted (from FAO, 2002b).

CONCLUSIONS

The above presentation of the current situation of the exploitation and management of the coastal pelagic stocks off Northwest Africa reveals the need for co-operation in the management of these resources. Although a process has been initiated to establish a mechanism of cooperation in the region, at present no complete mechanism facilitating the countries' work towards joint management of the shared resources is in place.

Facing an increasing pressure on the resources, the coastal countries will have to commit themselves to develop an even more active co-operation than today. Taking as a starting point examples from existing arrangements and agreements on cooperation from other parts of the world, actions such as the establishment of a catch quota system for industrial fisheries and a control of effort for artisanal fisheries (number of units and/or number of trips) could constitute a first stage. However, it is important to note that it will be necessary to continue the support to the scientific co-operation already in place and to intensify the degree of collaboration of the fishery administrations.

REFERENCES

Caramelo, A.M, Lamboeuf, M and Tandstad, M. (eds.). 2001. Report of the Workshop to plan the 1999 R/V Dr. Fridtjof Nansen survey in the northern CECAF area and the standardization of acoustic surveys in the region. Casablanca, Morocco, 18-22 October 1999. FAO Fisheries Report. No. 636. Rome, FAO: 62p.

FAO. 2001. Report of the FAO Working Group on the assessment of small pelagic fish off Northwest Africa. Nouadhibou, Mauritania, 24-31 March 2001. FAO Fisheries Report. No. 657. Rome, FAO: 133p.

FAO, 2002a. Report of the FAO Working Group on the assessment of small pelagic fish off Northwest Africa. Banjul, The Gambia, 5-12 April 2002. FAO Fisheries Report. No. 686. Rome, FAO. 2002.

FAO, 2002b. Report of the Workshop on the management of shared small pelagic fishery resources in Northwest Africa. Banjul, the Gambia, 30 April-3 May 2002. FAO Fisheries Report No. 675. Rome, FAO: 35 p.

FAOa, 2002c. Case study: Sardinella in Northwest Africa. Working paper presented at the Workshop on the management of shared small pelagic fishery resources in Northwest Africa. Banjul, the Gambia, 30 April-3 May 2002: 13p (bi)

FAOb, 2002d. Case study: The horse mackerels in Northwest Africa. Working paper presented at the Workshop on the management of shared small pelagic fishery resources in Northwest Africa. Banjul, the Gambia, 30 April-3 May 2002: 13p (bi)

FAOc, 2002e. Small pelagic fisheries in the Northwest Africa. Workshop on the Management of Shared Small Pelagic Resources Banjul, the Gambia 30 April – 3 May 2002.

Kecs, L., P.S. Diouf, P.S. K. Sané. 2002. Compte rendu de l'atelier : l'accès aux zones de pêche en Afrique de l'Ouest. 221p.

Owen, D. 2002. Legal and institutional aspects of management arrangements for shared stocks with reference to small pelagics in Northwest Africa. FAO Fisheries Report. *In press.*

SAMB, B et B. C. Dioh, 1996- Maîtrise Concertée de la Connaissance de la Valorisation et de la Gestion des Ressources dans les pays de la Commission Sous Régionale des Pêches (CSRP). Document technique de la CSRP.

SAMB, B. et M. H.O. EJIWEN, 1997. Document de compte rendu de la table ronde de la Commission Sous Régionale des Pêches. 18 au 20 Mars 1997 Praia Cap Vert.

UICN, 1999. La pêche en Afrique de l'Ouest : accords de pêche et perspectives. 35p.

ANNEX

Recommendations of the meeting Banjul, April 2002.

1. The work of the current FAO Working Group on the Assessment of Small Pelagics in Northwest Africa should be furthered and strengthened in order to maintain a high level of resource assessment studies in the coming years and the long-term future. Fisheries biologists should continue to exchange information, meet at least once a year to examine the state of the stocks and provide advice to fisheries administrations on management measures. Joint surveys should be conducted by scientists of the national research institutions in the region using national research vessels.
2. The FAO Working Group on the Assessment of Small Pelagics in Northwest Africa should consider inviting scientists from outside the region to participate in the Working Group.
3. Fisheries Scientific Institutions should identify research priorities and seek national budgetary allocations to sustain long-term research.
4. A precautionary approach towards the management of small pelagic stocks should be adopted to maintain a sustainable spawning stock. The basis for setting the total allowable catch (TAC) and fishing capacity for the next year should not exceed the average annual catch during the past five years in order to ensure a sustainable and rational exploitation of the small pelagics.
5. Countries should develop national management plans in support of a future joint regional management system.
6. An appropriate regional management system should be established around a scientific working group or committee and a management meeting proposing a scheme for a consultation mechanism between the coastal states sharing small pelagic stocks in North West Africa.
7. FAO should prepare the draft text of the proposed scheme and the next Steering Committee of the Nansen Programme should discuss the possibility of the Programme providing support to the countries concerned in holding a meeting to finalize and adopt the scheme as an international instrument.
8. Considering the need for active and competent personnel to effectively conduct the activities envisaged for sustainable management of small pelagics, it was suggested that a draft outline of a plan of accompanying measures, such as capacity building, be formulated by Mauritania on behalf of the participants in the FAO Working Group in collaboration with Norway and submitted to the next Steering Committee of the Nansen Programme.
9. While the scheme goes through the formal stages, it was recommended that participants sensitize their respective Governments on the need for funds to continue the activities which are currently undertaken by the FAO Working Group on Assessment of Small Pelagic Stocks in Northwest Africa after the present funding ends.

MANAGEMENT OF SHARED HAKE STOCKS IN THE BENGUELA MARINE ECOSYSTEM

by

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1. INTRODUCTION

The Benguela Current Large Marine Ecosystem (BCLME) can be loosely considered as covering the continental shelf between the Angola-Benguela frontal zone in Northern/Southern Angola and the Agulhas retoflection area, typically between 36 and 37 degrees South (Shannon and O'Toole 1998). It therefore covers the west coast of South Africa, the entire Namibian coast, and Southern Angola depending on the position of the Angola-Benguela front, which typically moves seasonally between 14 and 17 degrees South (see Fig. 1). The BCLME is one of the world's major, productive eastern-boundary currents. It is rich in both pelagic and demersal fish populations, supported by plankton production driven by intense coastal upwelling (see Boyer and Hampton, 2001; Sumaila and Vasconcellos, 2000).

A number of commercially important species in the Benguela Current Large Marine Ecosystem (BCLME) (e.g., hake, horse mackerel, deep sea red crab, and sporadically sardine and anchovy) are distributed or move seasonally across national borders, and can therefore be classified as shared stocks. A fish stock is said to be shared if its populations extend across, or migrate across the Exclusive Economic Zones (EEZs) of adjacent countries, and the stock is fished by more than one of these countries.[1]

Namibia and Angola negotiated an agreed maritime border between the two countries and an agreement was signed in the first half of 2002. The agreement makes provision for the fixing of a starting point of the maritime border at the Kunene River mouth running out westwards, parallel to the line of latitude.

[1] It should be noted that the material in this section draws heavily from Hampton et al. (1999).

The Namibian border with South Africa has not been agreed upon, and it is unlikely that this will be agreed upon in the near future. Historically, the northern bank of the Orange River boundary was agreed upon by the British and German colonial powers. Following independence in 1990, Namibia opened negotiations with the pre-1994 government in South Africa to have the border moved to the middle of the Orange River.

After 1994 the new South African cabinet repealed the agreement with the previous government of South Africa, and without an agreed land boundary the maritime border cannot be determined. A meeting in early 1992 between the two governments showed that the views of the two countries about where the maritime border should be differ. This difference in opinion (largely related to access of diamond deposits on the seabed) leads to a potential 'grey' zone that will need special attention in the management of shared stocks in the future - until the border can be agreed upon.

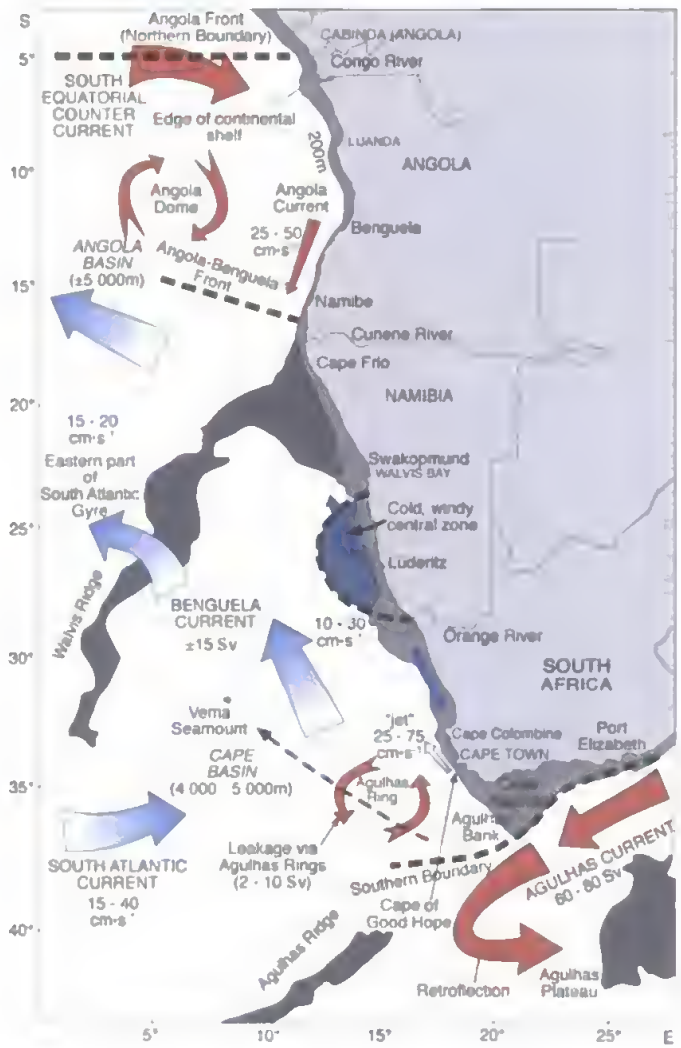

Figure 1: The Benguela Current Large Marine Ecosystem (BCLME)

This case study focuses on the hake stocks in the ecosystem, which are shared principally by Namibia and South Africa, and to a lesser extend Angola[1]. This species has been classified by a recent review (RFIS,

[1] Angola lands less than 0.5 percent of the total hake annual landings of *Merluccius capensis* and *Merluccius paradoxus*. A third species of hake is confined mostly to southern Angola but the population is smaller and does not support a large fishery. Most of the hake landed is *Merluccius polli*, which is not of the same quality as the other two species.

2002) as a prime candidate for cooperative management in the Southern African Development Community (SADC) region. In addition to its shared status, it is the most valuable commercial species exploited in the region.

2. FISHERIES IN NAMIBIA, SOUTH AFRICA AND ANGOLA

Summary data on the economic value of Namibian and South African commercial fisheries in 1996 and 1997, respectively, are set out in Table 1.

2.1 Namibia

The fisheries sector is the third largest of the Namibian economy, behind agriculture and mining. In recent years, the fishery has landed between 0.55 – 0.6 million tonnes of fish (MFMR, 2000), and contributed between 5-8 percent of the GDP. Exports were valued at N$ 2 833 million in 2000, making the sector the second-largest export earner behind mining. It is the second-fastest growing industry in the Namibian economy (behind tourism) with the value of production and exports now being some six times greater than at Independence. Domestic consumption in Namibia is estimated to be about 12-14 kg per person in 2,000.

Table 1: Value of major industrial fisheries in Namibia and South Africa in 2000 and 1997 respectively. Namibian data from MFMR. South African data from Stuttaford (1998). Note: N$1 = R1. ** Includes midwater trawl catches

FISHERY	NAMIBIA (2000)		SOUTH AFRICA (1997)	
	Landed value (Million N$)	Wholesale (processed) value (Million N$)	Landed value (Million R)	Wholesale (processed) value (Million R)
Pelagic				
Canned fish	26.4	80.2	28.3	291.0
Fish meal & oil	14.4	23.7	45.8	66.6
Bait			3.4	8.4
Total	40.8	103.9	77.5	366.0
Demersal				
Bottom trawl	985.8	1,445.4	406.1 **	1 000.5 **
Midwater	663.1	669.3		
Deep-water	22.7	33.3		
Longline	101.4	214.4	22.2	40.0
Total	1,773	2,362.4	428.3	1 040.5
Crustacean				
Rock lobster	32.0	34.1	50.9	102.2
Red crab	37.4	37.4		
Total	69.4	71.5	50.9	102.2
Line	13.4	13.4		
Tuna	31.1	31.1	10.3	12.9
Snoek			24.9	48.5
Other	48.6	48.6	32.7	44.7
Total	93.1	93.1	67.9	106.1
Total	1976.3	2530.9	624.7	1 614.7

The fisheries sector is extremely important in the social economy of Namibia, particularly, in Walvis Bay, which is the major fishing port and where most of the processing plants are situated. Local employment in

the sector grew rapidly after Independence, with an estimated 6 000 jobs having been created between 1991 and 1994. The integration of Walvis Bay into Namibia in 1994, and the removal of the uncertainty regarding the port's future, stimulated an influx of investment in the fishing industry and subsidiary service industries with a further growth in employment. The number of people directly employed in the fisheries sector since 1996 has been about 15 000, of which some 7 500 are fishermen. Of these 20 percent are foreigners, mainly employed in the horse mackerel and tuna fisheries, a proportion that has decreased from around 66 percent in 1993. It was projected that by the year 2 000, the total number of people employed in the fisheries sector would have risen to above 20 000. However, the almost total collapse of the Namibia pilchard fishery has limited employment opportunities in the catching and associated onshore canning industry (MFMR, 1994-2000).

In 2000 the Namibian fishery landed products valued at N$ 2 159 million that after processing were valued at N$ 2 852 (MFMR, 2000). The demersal fishery is the most valuable fishery in Namibia, representing 55-60 percent of these values. About 90 percent of the catch value is hake, which is either frozen at sea by demersal trawlers or is landed as wetfish taken either by trawl or longline. Monkfish make up most of the remainder of the demersal catches, with the average landed value of the catch in recent years amounting to about N$ 70 million per year (Olsen 1997). Almost the entire demersal catch is exported.

2.2 South Africa

South Africa's living marine resources of the Benguela Current form the basis of a fishing industry which supports some 26 000 people (mostly in the Western Cape), and supplies food to the whole Southern African subregion. In 1998 the South African fishing industry caught a total of 678 125 tonnes of fish, shellfish and seaweed nationwide, of which more than 90 percent was taken from the Benguela Current region. The wholesale value of the total processed output in this year was estimated at R 2 077 million, with an export value of R 1 350 million, which is less than the value of the Namibia fishery. Fishing is particularly important in the social economy of the Western Cape, where some entire coastal communities depend directly or indirectly on fishing for their livelihood. However, the fishing industry yields less than 1 percent of South Africa's GDP.

Economically, the trawl fishery is the most important sector of the South African fishing industry. Catches of hake, which amounted to 146 000 tonnes in 1998, usually contribute about 75 percent of the trawl catch and about 80 percent of its value. In 1998 the landed value of processed products from a total demersal trawl catch of 200 000 tonnes was R 473 million. The value of hake exports in 1998 exceeded R 880 million; about 43 percent of the total revenue from all South African fish and shellfish exports.

2.3 Angola

The fisheries sector is very important in Angola, being the third-most important industry after oil and diamond mining. It provides nearly half of the animal protein of the country, and is an important source of employment and food to populations of the coastal regions, where it is often the only source of livelihood for the poorer population groups. Domestic consumption of fish, which was estimated at 11.1 kg per person per annum in 1994, is one of the highest in the region.

According to the results of a survey conducted in 1992, there were at that time around 30 000 workers directly involved in activities of the fisheries sector, of which some 18,000 were involved in artisanal fisheries. The remainder were involved in industrial fisheries and public administration. In addition, it was estimated that some 5 000 persons (mainly women) were involved in informal fish trade activities. A more recent report (Delgado and Kingombo 1998) puts the number of artisanal fishermen a few years later at over 23 000, and the number of people involved in informal fish trading at between 2 ,000 and 30 000. Current numbers directly involved in fishing (not including subsistence fishers) are estimated at 25 000 (Duarte, 2002 pers. comm.). Many artisanal fishers are not able to make a living solely from fishing, and supplement their incomes by, for example, agricultural and commercial activities.

At present, roughly half of the revenue from fish and fish products in Angola comes from exports, which varied in value between N$ 270 million in 1993 and N$ 460 million in 1995. Prawns are the most important product, making up 48 percent of the total revenue from the fishery sector in 1995, for example. The main

export markets are Europe for prawns and demersal fish, African countries for small pelagic fish including horse mackerel, and Japan for tuna and crab.

In the following sections, the paper discusses the nature of the hake fisheries of the BCLME, explores the rationale for managing the hake stocks of the BCLME under cooperative agreement and describes some policy, institutional and research initiatives that are supporting the regional development of a shared management framework. One can use ecological, economic and legal arguments to make the case for the need for cooperative management of the hake stocks of the BCLME and these are briefly explored. Finally, a summary of problems and challenges that need to be resolved in order to put in place a mutually beneficial cooperative arrangement for the sustainable management of these valuable resources is given.

3. NATURE OF THE HAKE FISHERIES

Off Namibia and South Africa the Cape hake (*Merluccius capensis*) and the deep water hake (*Merluccius paradoxus*), are mainly caught in bottom trawls, although important longline fisheries also exist in both countries and there is a developing small-scale hand line fishery off South Africa. Off Angola there is a relatively small bottom trawl fishery for Benguela hake *Merluccius polli* and *Merluccius capensis* (in the extreme south). In central and northern Angola a bottom trawl industry takes demersal species such as Dentex spp., Red Pandora (Pagellus bellotti), deepwater shrimp and a by-catch of hake.

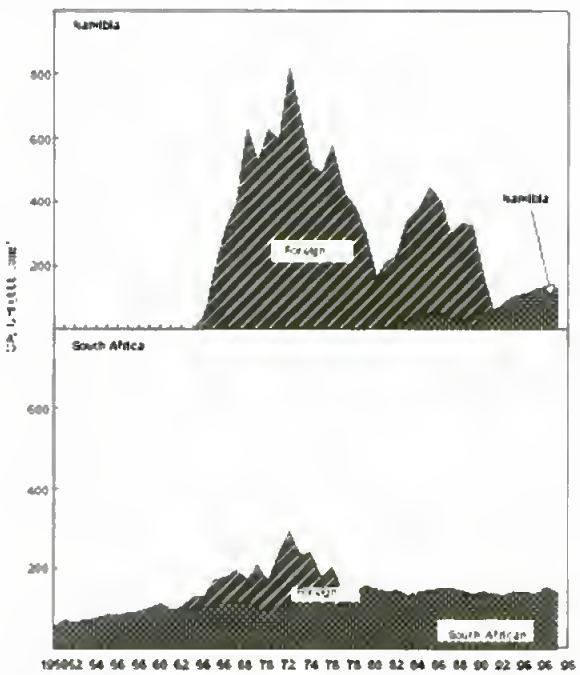

Figure 2: Catches of hakes off Namibia and South Africa by foreign and local fleets since 1950

Annual catches of Cape hakes (Merluccius capensis and *Merluccius paradoxus* combined) in Namibian and South African waters by local and foreign fleets since 1950 are shown in Fig. 2. Although the demersal fishery began around the turn of the century, catches prior to 1950 seldom exceeded 50 000 tonnes per annum, with most fishing effort being in South African waters. The Namibian fishery started in the late 1950s. In the early 1960s there was an explosive increase in effort and landings throughout the Benguela, with the arrival of foreign trawling fleets, and by 1972, the annual hake catch in the south-east Atlantic exceeded 1.1 million tonnes. Subsequently, catch rates and landings of hake declined sharply, and conservation measures were introduced, including the declaration of a 200-mile fishing zone by South Africa in 1977. Since then hake catches in South African waters have remained relatively stable at just over 140 000 tonnes per year. Off Namibia, hake catches between 1973 and Independence in 1990 averaged 500 – 600 000 tonnes annually, almost exclusively taken by foreign fleets. At Independence, strict conservation measures were introduced, including the exclusion of foreign vessels. The hake catch is now taken exclusively by

Namibian-registered vessels and the annual local catch has risen from 55,000 tonnes at Independence to around 160-180,000 tonnes over the period 1996 – 2002 (UNDP, undated.). Catches of *Merluccius capensis* in Angola are of a lower order, amounting to less than 1 000 tonnes per year in recent years, catches of *Merluccius polli* are higher, averaging between 20-40 000 tonnes.

3.1 Stock Distribution

The distributions of the three species of hake in the Benguela region are shown in Figure 3. *Merluccius polli* occurs predominantly in Angolan waters, and is caught on the shelf slope as a by-catch in the prawn fishery and by deep water trawlers in the south, where its distribution overlaps with that of the shallow-water Cape hake *Merluccius capensis*.

Cape hake and the deep water hake are found throughout Namibian and South African waters. As might be assumed, *Merluccius paradoxus* occurs in deeper water than *Merluccius capensis*, although the two species co-occur at intermediate depths (Payne 1989). Larger individuals of both species are found at greater depths than smaller fish, and there is little overlap in the distribution of mature fish. There is however overlap between mature *Merluccius capensis* and juvenile *Merluccius paradoxus*, which results in considerable predation of the smaller fish. *Merluccius capensis* is the more common species off Namibia, especially in the central region, although *Merluccius paradoxus* has been increasingly abundant and more widely distributed in deeper waters in recent years. The increasing abundance of *Merluccius paradoxus* could also be an artefact since historic sampling may have inaccurately identified *Merluccius paradoxus* as *Merluccius capensis* (Oelofsen, 2002 pers. com.).

Merluccius paradoxus predominates off the west coast of South Africa. It is believed that this stock may be the origin of the Namibian *Merluccius paradoxus* stock. A second population of *Merluccius capensis*, which for management purposes is treated as a separate stock, and exists mainly over the Agulhas Bank.

Fig. 3 suggests that the West Coast stocks of both species are probably shared between Namibia and South Africa, although catch patterns between Lüderitz and the Orange River indicate that there may be a measure of separation between the Namibian and South African *Merluccius capensis* stocks. In contrast, there is evidence from surveys (e.g. Strømme 1996) and commercial catches that, since 1990, there has been a gradual migration or expansion of *Merluccius paradoxus* into southern Namibia and farther north, probably from South African waters.

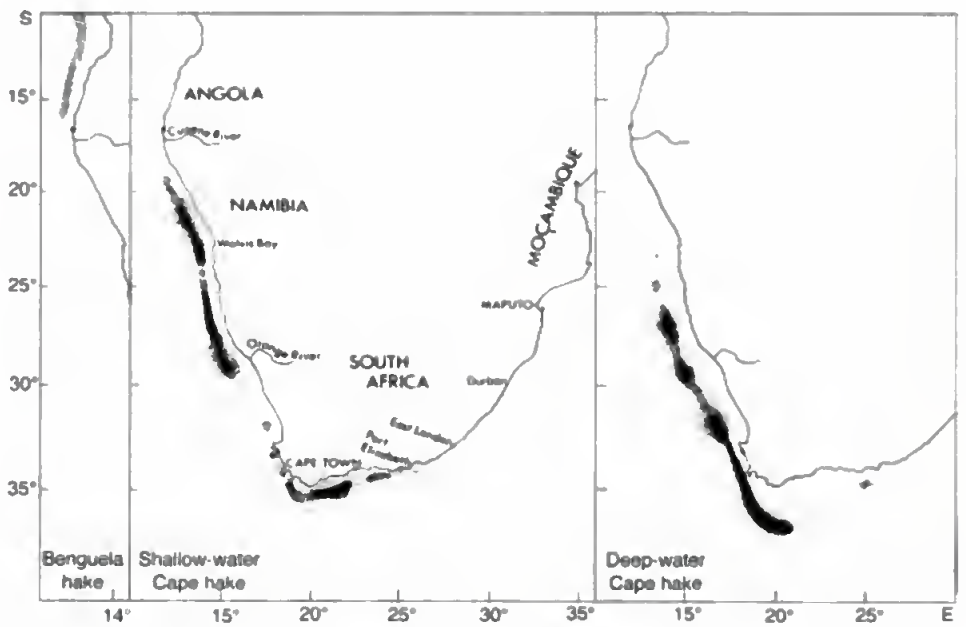

Figure 3: Distribution of the three hake species in the Benguela ecosystem (from Payne1989).

3.2 Life History

Cape hakes spawn in midwater throughout the year, with a peak in early summer for both *Merluccius capensis* and *Merluccius paradoxus*, and a secondary peak in late summer for *Merluccius paradoxus* in the southern Benguela. Most *Merluccius paradoxus* spawning is thought to take place along the edge of the Agulhas Bank, but spawning also occurs over the shelf-break west of St Helena Bay and off central Namibia. In the latter region, *Merluccius capensis* spawn most frequently between 160 and 250m depth, spawning starting earliest in the shallower waters. The eggs of both species are concentrated around the depth of the thermocline, and the dispersal of *Merluccius paradoxus* eggs and larvae produced on the South Coast could be similar to that of the pelagic fish spawning there, resulting in young *Merluccius paradoxus* being plentiful between Cape Columbine and the Orange River. To the north, 0-group *Merluccius capensis* are particularly abundant off Walvis Bay, which appears to be a nursery area. Juveniles of this species are also plentiful off the Orange River and south to about Cape Columbine, sometimes co-occurring with pelagic fish recruits in winter, on which they feed (particularly on anchovy). Like the pelagic recruits, juvenile hake in the Orange River area move south against the current as they grow older, but unlike the recruits of the pelagic species young hake tend to move offshore as they move south.

This section demonstrate the need for cooperation with regards to the hakes stocks because it clearly shows that the hakes caught in South Africa, Namibia and to a much lesser extent Angola, are essentially from the same pool, that is, they are shared.

3.3 Policy and Legal Background

It is almost impossible for countries that share stocks not to enter into co-operative agreements if the range of international legal requirements are instituted at the national level. The relevant legal frameworks and their reference to the countries bordering the BCLME are briefly explored below.

3.3.1 The National Framework

In all three countries bordering the Benguela Current it is national policy to utilise living marine resources on a sustainable basis for the benefit of the nation, and to base the management on scientific information and principles. Ultimate responsibility for control measures rests with the State in all three countries.

In Namibia, a 200 nautical mile Exclusive Economic Zone was declared at Independence in 1990, followed by the promulgation of a new Sea Fisheries Act in 1992, and the introduction of a new national policy on exploitation rights and quota allocation in 1993. This Act has now been replaced by the Marine Resources Act (Act 27 of 2000) and the National policy is being revised in its totality to incorporate the subsequent policy statements that followed after the adoption of the 1993 policy document. A major emphasis has been placed on Namibianization of all sectors of the fishing industry and the building up of local research and management capacity. The new Act (as did the previous Act) makes provision for a Marine Resources Fund and 80 percent of these funds are allocated for research and 20 percent for training. Namibia has established a Sector Coordinating Unit supported by the Ministry of Fisheries and Marine Resources to discharge her responsibility as the country responsible for coordinating marine fisheries activities for the SADC region.

In South Africa a new Act (the Marine Living Resources Act of 1998) has recently been promulgated. It includes in its objectives the achievement of broad and accountable participation in decision-making processes, and the restructuring of the fishing industry to redress historical imbalances and achieve equity within the industry. A Consultative Advisory Forum (CAF) is responsible for advising the Minister of Environmental Affairs and Tourism, on the management and development of the fishing industry (including the setting of TACs), research direction and allocation of a Marine Living Resources Fund. The Fund receives income from levies, licences, penalties and other sources, which permits its disbursement to spheres of fisheries management (e.g. administration, compliance) other than only research and development.

In Angola the nation's marine and inland fisheries are managed and developed in terms of the Fisheries Act, which was developed with the assistance of the FAO and promulgated in 1992. The Act covers such aspects as fisheries management (which is implemented through various Executive Decrees governing different

sectors of the fishery), planning and licensing, the control of the quality and export of fish products, and surveillance and enforcement. In recent years, with the move to a market economy in Angola, and the privatisation of large State-owned companies, the State has limited its activities to the management of the resources, surveillance, support of development and the creation of infrastructure.

3.3.2 Regional Initiatives Supporting the Management of Shared Stocks

Of particular interest to the management of shared stocks are a number of initiatives that have been supported and developed within the framework of the Southern African Development Community (SADC). These initiatives are briefly explored below with particular relevance to their impact on the:

- knowledge about resource distribution and movement;
- mandate for management
- political will to promote cooperative management
- institutional arrangements;
- decision criteria for the allocation of shared resources;
- access provision for new entrants and membership and participation rights; and,
- sharing fisheries management functions and responsibilities.

The Southern African Development Community (SADC)

SADC was established to facilitate cooperation amongst its 14 Member States in all areas necessary to further regional development and integration, including fisheries (SADC Treaty, 1992). To coordinate sectoral activities 21 Sector Coordinating Units (SCU) were established and responsibility for marine fisheries was delegated to Namibia. Currently, a total of eight coastal Southern African and Indian Ocean Island states are members of SADC, thereby putting the entire coastline of both sides of the Southern African subcontinent under the auspices of SADC. Such geographical coverage gives the SCU an important role in facilitating the development of transboundary management of the region's shared stocks. Since its establishment the SCU has had responsibility for coordinating the development and implementation of a Programme of Action (POA). The POA contains a number of projects that directly support the development of future management of shared stocks within the region. In fact, all of these projects specifically recognise the importance of shared stocks management and all have a mandate to address particular aspects of the required transboundary management framework. The POA includes the: -

(i) Regional Fisheries Information Systems Project (RFIS);
(ii) Monitoring, Control and Surveillance of Fishing Activities Project (MCS);
(iii) The Policy Harmonisation Project;
(iv) BENEFIT Programme; and,
(v) The Benguela Current Large Marine Ecosystem Programme (BCLME) Assessment (which is being implemented) The Agulhas and Somali Current Large Marine Ecosystem Project is currently being developed.

As part of SADC's restructuring plans all SCUs will be phased out by the end of 2002 and will be amalgamated within four cross sectoral directorates. Both marine and inland fisheries will be coordinated through the Food, Agriculture and Natural Resources Directorate.

As its name would suggest RFIS is seeking to improve the management of the regions fisheries by improving the effective use of information. Two areas of the project's work are particularly relevant here. The project supports an information management specialist within the BENEFIT Secretariat (which directly covers the geographic area of the Benguela Current region) and has commissioned a review of information available that would underpin the wider recognition of the need for transboundary management within the region. The review aims to provide background information on the state of shared stocks in the SADC region, which will form the basis for a regional workshop. The aim of this workshop (which will be supported and involve contributions from all of the regional projects) will help set priorities for future actions with regard to the development of appropriate and effective shared stocks management framework within the SADC region.

The MCS project is seeking to not only develop national capacity in all aspects of MCS but is specifically seeking to provide solutions for transboundary management issues. Project activities will include developing a regional vessel registry, improving planning capacity to address regional deployment of MCS assets and providing legal support to address transboundary legal issues such as hot pursuit, long-arm jurisdiction and grey zones.

A recent product of the Policy Harmonisation project is a comparative analysis of legal frameworks of SADC coastal states (see Kuemlangan 2001). The objective of this study is to facilitate the harmonisation of marine fisheries laws between SADC member states, in particular, regarding management of shared stocks.

The BENguela Environment Fisheries Interaction and Training (BENEFIT) Programme is a regional marine research and training programme involving Angola, Namibia and South Africa. The Programme is aimed at improving knowledge and understanding of the dynamics of key transboundary commercial stocks in the Benguela (primarily hakes, horse mackerels, small pelagic fish and crustaceans) and of linkages between environmental processes and stock dynamics, with the broad objective of improving management of these resources. BENEFIT has the full support of the Angolan, Namibian and South African governments, and of SADC, all of which are represented on a Management Action Committee, which guides the Programme through a network of Committees and Working Groups, on each of which all three countries are represented. International scientific guidance is provided by a Scientific Advisory Panel, whose members are selected in their personal capacities from France, Germany, Norway, South Africa, USA and the United Kingdom. All the projects and training undertaken through BENEFIT are regional and will directly support either an improved information base or capacity development that will in turn underpin transboundary management (UNDP, undated).

The Benguela Large Marine Ecosystem Programme is an initiative supported through the Global Environmental Facility (GEF) and will strive to foster holistic approaches to ecosystem management. Key areas being addressed include living marine resources, environmental processes, pollution and biodiversity. The project is seeking to address not only problems that have an ecosystem impact but also problems that arise because of their transboundary nature (e.g. such as shared stocks). It is envisaged that there will be close links between the BENEFIT and BCLME Programmes, which although differing in emphasis and scope, will be mutually complementary. It is widely accepted that BENEFIT will be the research arm of BCLME. An important goal of the BCLME project is to facilitate the establishment of a Benguela Current Commission, which would provide for the institutional basis for future transboundary management in the future (UNDP, undated).

The Agulhas-Somali Large Marine Ecosystem Programme focuses on the South West Indian Ocean region and the Programme is being developed with the active support of the World Bank and UNDP. It consists of three interlinked projects. A Fisheries Project will undertake investigatory research into the shared and straddling stocks of the participating member states. An Ecosystem Assessment project will investigate related transboundary oceanographic processes and a Coastal Pilot project seeks to promote the better management of coastal artisanal fisheries in South Africa, Mozambique and Tanzania.

The SADC Protocol on Fisheries

Underpinning SADC's sectoral approach is an obligation to develop binding regional policy frameworks. One of the recent (2002) key outputs from the sector that has been facilitated by the SCU has been the SADC Protocol on Fisheries. All 14 Member States are signatories to this Protocol and states are seeking to incorporate the provisions into national legislation and activities, with three already ratifying the Protocol. The Protocol invokes all recent international legislation, agreements and codes and contains a number of provisions, which explicitly refers to cooperative management of shared stocks by countries in the region. The objective of this Protocol is to promote responsible and sustainable use of the living aquatic resources and aquatic ecosystems of interest to State Parties. Article 4 of the Protocol goes on to state that Subject to Article 5, responsibility for the implementation of the SADC Protocol is primarily national, but in the case of shared resources, State Parties shall co-operate with one another to ensure that the objective of this Protocol is achieved. Article 5 states that State Parties shall take measures, at national and international levels, suitable for the harmonisation of laws, policies, plans and programmes on fisheries aimed at promoting the objective of the Protocol. Article 7 of the Protocol is specifically on the management of shared stocks.

Finally, Article 18 relates to the requirements of collecting and sharing information necessary to promote transboundary management.

The Protocol provides for a binding policy framework, which accommodates all recent international provisions seeking to improve natural resource and ecosystem management. It therefore sets out a binding and fundamental commitment to shared stocks management and will provide a framework against which individual and collective action by Member States can be monitored.

3.3.3 The International Framework

Angola and Namibia are signatories to the FAO Code of Conduct for Responsible Fisheries. South Africa is yet to sign, but has agreed in the interim to abide by its provisions.

Angola, Namibia and South Africa have all ratified UNCLOS and have voted in favour of its Convention on Transboundary and Highly Migratory Stocks, and the United Nations Implementing Agreement (UIA). Subject to that Agreement, Angola, Namibia and South Africa, along with the United Kingdom (acting on behalf of its Overseas Territory St Helena and its island dependencies of Ascension and Tristan da Cunha), have formulated the South East Atlantic Fisheries Organisation (SEAFO) for the conservation and management of straddling and High Seas stocks in the South-east Atlantic. Other parties to SEAFO include the European Union, Norway, Russia, Ukraine and the USA. The Agreement has been signed and is the first Agreement concluded under the UIA.

Angola and South Africa are both long-standing members of the International Commission for the Conservation of Atlantic tunas (ICCAT) and Namibia has recently joined the organisation.

Namibia and South Africa are both members of the Convention for the Conservation of Antarctic Living Marine Resources (CCAMLR).

3.3.4 Summary

The common stated objective of all the relevant international regional and national legislation and policy frameworks is to promote the 'responsible and sustainable' use of marine resources. This can only be attained in the case of shared stocks through negotiated, cooperative agreements between the relevant participating countries.

Given the regional importance of the hake fishery, particularly for Namibia and South Africa, considerable social and economic benefits will be lost to the citizens of each country if they continue to manage the resource independently.

4. ECONOMIC RATIONALE FOR SHARED MANAGEMENT OF HAKE

From the discussion in section 2, it can be seen that the fisheries sector ranks high in national importance in Namibia. For instance, fish products can account for up to a quarter of all exports (second only to diamonds), and 5.2-7.9 percent of GDP (Tapscott, 2001 and MFMR, 1996-2000). South Africa has a much larger and diverse economy and only about 0.5 percent of GDP is contributed by the fisheries sector and exports are smaller than those of Namibia. The industry is however an important source of revenue and food in coastal areas, especially in the Western Cape Province, where about 90 percent of all South African hake are landed. The fishing sector is an influential source of employment in Namibia, although, in this regard, the fishing sector makes a much smaller relative contribution to the South Africa economy. Fishing in Angola is less important in terms of formal economic activity but is essential to the social fabric of the country in terms of employment and food security. All it all, the fishing sectors in Namibia, South Africa and Angola are economically and socially important. Even in South Africa, where the economy is much more diverse, the socio-economic incentives of optimising resource rent from the hake fishery are significant.

It has been shown by many economic studies that when stocks that are considered shared are exploited in the absence of cooperation, the result of such exploitation in the long run is unquestionably undesireable. Munro (1979) demonstrated the gains that can result from cooperative management when two countries (i) with

different harvesting cost, (ii) face different selling prices for fish caught, and (iii) have different discount rates, exploit a shared stock. Fisher and Mirman (1996) show how natural interaction between fish species (e.g., predator-prey, relationships) can lead to heavy losses if such species are managed non-cooperatively. Even when a given fish remains within the national borders of a country, there are gains to be made from cooperative agreement if different groups of fishers operate in the fishery. For instance, Sumaila (1995) showed that when two different types of vessel gears with different selectivity patterns are employed to exploit the same stock of fish, cooperative management yields some significant gains. With respect to the shared hake stocks of the BCLME, preliminary work by Armstrong and Sumaila indicate that the potential cost of non-cooperative management of the hake stocks of the BCMLE is significant; probably amounting to about 25 percent of the discounted rent that is currently being obtained by Namibia and South Africa (Armstrong and Sumaila, in press).

5. LESSONS LEARNED: SUCCESS, PROBLEMS AND POTENTIAL SOLUTIONS

5.1 Knowledge about resource distribution and movement

Knowledge about resource ecology is the basic building blocks needed for developing a meaningful cooperative agreement for the management of the hake stocks. One reason for the lack of agreements for cooperative management of shared stocks in the SADC region to date is the lack of adequate knowledge about the distribution and movement of the fish stocks found in the region.

A number of gaps in scientific understanding of the dynamics of the Benguela Current's marine resources have been reported (UNDP, undated). Briefly, they can be summarised as:

- Inadequate definition of stocks and understanding of factors affecting the separation and/or interchange between them, especially for stocks which are shared between countries or move between them, such as hake. Lack of this information makes it difficult to manage these resources on a national basis and is likely to complicate any attempts at regional management.
- Inaccurate or non-existent information on basic biological characteristics such as growth and natural mortality rates, reproductive characteristics, recruitment variability and population age structure for most of the harvested species. These are important input parameters for population dynamics models used in the region (which are themselves often inadequate). A particular problem for most species is the inadequacy and lack of validation of ageing techniques.
- Inadequate absolute estimates of population size and questionable indices of population trends for hake, due to deficiencies in the methods used to obtain these estimates. Furthermore, few attempts have been made to assess the accuracy or precision of the estimates, making it difficult to assess their value.
- The lack of Operational Management Procedures based on population models is seen locally as a serious problem, precluding any meaningful form of risk analysis or quantitative evaluation of harvesting strategies for these resources. This is a particular problem in Angola, and to a lesser extent, Namibia.
- Inability to predict the effect of environmental perturbations on resource dynamics for any species with sufficient confidence for the predictions to be used quantitatively in resource management.

Those of the above which are transboundary problems for hake management are summarised in Table 2. Included in the Table is an indication of the immediate and root cause of each of the problems listed.

Table 2. Immediate and root causes of major transboundary problems in the management of the region's hake resources.

Issue	Problem	Immediate cause	Root cause
Management of hakes (South Africa/ Namibia)	Inadequate information on identity of M. capensis and M. paradoxus stocks in southern Benguela	Lack of transboundary surveys	Lack of regional agreement(s) and structures under which transboundary surveys could be organised. Shortage of funds and manpower for surveys
	Inadequate understanding of life history (spawning areas, larval dispersal patterns, migration of juveniles and adults etc.)	Lack of ichthyoplankton surveys and migration studies in both Namibia and South Africa	Shortage of funds and manpower for surveys and data analysis. Low priority given to ichthyoplankton work. Lack of structures for organising transboundary surveys and collaborative migration studies
	Questionable comparability of stock estimates in Namibia and South Africa	Different survey techniques, sampling gear and ageing methods. Different interpretations of commercial catch data	Inadequate intercalibration and comparison of techniques. Lack of regional structures for standardising methods
	No unified Operational Management Procedure or common exploitation control methods	Different approaches to management and exploitation control in the two countries, and different level of modelling skills	Different national exploitation policies and constraints. Lack of structures for regional resource management. Shortage of modellers, particularly within NatMIRC
Inadequate under-standing of effects of transboundary environ-mental perturbations on abundance, distribution, behaviour and production	Lack of studies on interaction between hake and their environment on appropriate scales	Shortage of funds, vessels and staff for appropriate monitoring and dedicated behavioural studies	

Without the above knowledge and information, it becomes difficult to act. Fortunately, current efforts coordinated through the SCU's POA are attempts to provide the relevant information needed (See the section above and RFIS, 2002).

5.2 Mandate for management.

Although there is currently no transboundary management of shared stocks in the Southern African region (RFIS, 2002), a mandate for the development of such measures clearly exists. Not only is this mandate enshrined in the national legislation of South Africa, Namibia and Angola there is also an international obligation arising from the various international instruments they are party to. More fundamentally, a clear mandate is also enshrined within the Protocol on Fisheries, which explicitly commits all SADC states to transboundary management.

5.3 Political will to promote cooperative management.

Given the current level of activity on the development of management frameworks for shared stocks in the SADC, including the recently signed Protocol on Fisheries, there is clear political will to address the issue. In the particular case of hake, the fundamental importance of these stocks in Namibia and South Africa both economically and socially would suggest that this political momentum should support the implementation of transboundary management.

From our understanding of the economic and social importance of the fishing sectors in the two countries, it would seem that Namibia is likely to have strong political interest in the cooperative management of the hake stocks of the Benguela Current Ecosystem. In South Africa, even though the national contribution of the sector economically and socially is relatively smaller, the concentration of the hake sector in Western Cape will raise its political profile in that region. The South African and Namibian fishing industries have also attracted a good deal of political attention as an industry with potential to provide employment and income to groups previously disadvantaged through apartheid policies.

5.4 Institutional arrangements

There are currently no formal institutional arrangements specifically in place for the cooperative management of hake by South Africa and Namibia. However, there are a number of national, regional and international arrangements that can serve an interim function in this regard, while more specific arrangements are made. The government institutions are charged with the responsibility to manage the fisheries resources in a 'responsible and sustainable' manner. This implies in the case of shared stocks that these institutions have to work to ensure the cooperative management of these resources. Indeed, South Africa and Namibia already carry out regular management liaison meetings on species of common interest, including hake. These meetings could easily contribute to the basis for future shared management agreements between the two countries. The cooperative involvement of South Africa, Namibia and Angola in the development and implementation of the BENEFIT Programme and the development of the BCLME project are also useful signs that joint decision making is well established. At a regional level it is proposed that a Benguela Current Commission be established to take on the mantle of managing transboundary issues within the BCLME. This regional commitment has also been manifest at the international level, the Southeast Atlantic Fisheries Organization (SEAFO) has recently been created to deal with the joint management of transboundary and high seas fishery resources in the region. A fundamental basis for the successful and speedy formation of this Organisation was the commitment of the four coastal states involved to the principles and process of collaborative management.

5.5 Decision criteria for the allocation of shared resources.

Because there are currently no formal cooperative management arrangements for hake, there are no decision criteria for sharing the benefits of cooperation. While there are undoubtedly many useful experiences to be drawn upon from past and current regional initiatives this area probably represents the most pressing gap to be addressed. Determining the allocation criteria and procedures for their implementation is probably the most difficult task to undertake regarding shared stocks management. In essence this will also determine the shape and content of the management framework that will be acceptable and will have implications for

almost all of the related management processes, including those concerned with institutional structures and research.

In many instances the scope and depth of the decision making criteria that will be acceptable to the states will determine the requirement for supporting information systems, particularly those that might be driven by the need for long-term research.

In order to be able to understand the implications of one set of decision criteria over another the up and downstream costs and benefits must be clearly understood. To lay the foundations for this, some initial economic research will be essential to assess these (e.g. see Nash 1953 and Munro, 1979).

5.6 Access provision for new entrants and membership and participation rights

In the case of hake, this point does not seem to be initially very relevant. This is because hakes are essentially transboundary and are not caught by high seas fisheries. The key point here, in our opinion, is how an agreement between Namibia and South Africa, the principal exploiters of the resource, should be designed to make room for Angola, a relatively minor participant currently. Such provisions are of some relevance within the Benguela Current as environmental variability can significantly affect the distribution patterns of the exploited resources. The changes in the distribution of *Merluccius paradoxus* which has probably increased the Namibian fisheries dependence on recruitment derived from South Africa has already been noted. Further environmentally driven events may result in continued changes to the distribution patterns of the Cape and Deepwater hakes and an increasing abundance off Angola. There are lessons to be learnt from the agreement between Norway and Russia on the management of the shared Northeast Atlantic cod stocks. In that case, the two principal countries exploiting the resource, namely, Norway and Russia, determine the allocation of the TAC to both themselves and third countries - mainly EU member countries who are 'minor' exploiters of the resource (see Armstrong and Sumaila, 2001).

5.7 Sharing fisheries management functions and responsibilities

This is an important issue that needs to be adequately addressed to ensure that any cooperative arrangement will be successful. The activities of the previously noted regional projects, particularly those that involve the development and deployment of shared resources, will contribute to finding solutions to this issue.

6. CONCLUDING REMARKS

This paper has discussed the need to manage the shared hake stocks of the Benguela current ecosystem from ecological, economic and legal points of view. The paper also shows that even though there are currently no formal agreements for managing the hake stocks, the basic foundation for the development of such agreements has already been laid. The contribution then proceeds to discuss a number of issues related to the success, problems and challenges that need to be resolved in order to bring into being cooperative management of this important fish stocks of the Southern African region.

A number of priority areas for actions are suggested below:

- Initiate discussions on the institutional structures and arrangements that will be responsible for shared stock management in the Benguela Current;
- Undertake economic research that will underpin the selection of decision making criteria for the hake fishery, including the cost-benefits of the supporting information systems and monitoring, control and surveillance operations that particular management frameworks will require;
- Ensure that current research is prioritised to addressing gaps that limit the development of shared stock management frameworks; and,
- Develop and put in place a unified operational management procedure for hake.

REFERENCES AND OTHER LITERATURE

Armstrong, C.W. and U.R. Sumaila 2003. The Namibian-South African Hake Fishery – Costs of non-cooperative management. In Sumaila, U.R., S. Steinshamn, M. Skogen and D. Boyer (eds.) Ecological, Economic and Social Aspects of Namibian Fisheries, Eburon Publishers, Holland, in press.

Armstrong, C. W and U.R. Sumaila 2001. Optimal allocation of TAC and the implications of implementing an ITQ management system for the North-East Aretic cod. Land Economics, 77, 350-359.

Boyer, D.C. and I. Hampton. 2001. An overview of the living marine resources of Namibia. In: A Decade of Namibian Fisheries Science. Payne, A.I.L., Pillar, S.C. and R.J.M. Crawford (eds.). S. Afr. J. mar. Sci. 23: 5-35.

Delgado, F. and P.A. Kingombo 1998 – (Effect of) Coastal development and marine environment on artisanal fisheries (in Angola). Collected papers, First Regional Workshop, Benguela Current Large Marine Ecosystem (BCLME) Programme, UNDP, Cape Town, South Africa, 22-24 July 1998. 11pp.

Duarte, A. 2002. Personal communication with Deputy Director for the Institution for Artisanal Fisheries, Luanda, Angola.

Fischer, R.D. and Mirman, L.J. 1996. The complcat fish wars: biological and dynamic interactions. Journal of Environmental Economics and Management 30(1), 34-42.

Hampton, I., Boyer, D.C., Penney, A.J., Pereira, A.F. and M. Sardinha. 1999. Integrated overview of fisheries of the Benguela Current region. Thematic report for the Benguela Current Large Marine Ecosystem Programme. Windhoek: United Nations Development Programme: 92 pp.

Kuemlangan, B. 2001. Harmonisation of marine fisheries policy within the SADC Coastal Countries: Comparative analysis of the fisheries legal frameworks of certain SADC coastal countries: status and options. FAO Technical Assistance Project Report TCP/RAF/8933 (A).

MFMR, 1994-2000. Annual reports of the Namibian Ministry of Fisheries and Marine Resources.

Munro, G.R. 1979. The optimal management of transboundary renewable resources. Canadian Journal of Economics 12, 355-376.

Nash, J.F. 1953. Two-person cooperative games. Econometrica 21, 128-140.

Olsen, S. 1997. Research and resource values in the Nambian marine commercial fisheries. Namibian Ministry of Fisheries and Marine Resources Annual Research Meeting, Swakopmund, 17-21 November, 1997. 6pp.

Payne, A.I.L. 1989 – Cape hakes. In Oceans of Life off Southern Africa. Payne, A.I. L. and R. J. M. Crawford (eds.). Cape Town; Vlaeberg: 136-147.

RFIS, 2002 (in prep). A Review of Information relevant to Development of Effective Cooperative Arrangements for the Management of Shared Fish Stocks in the SADC Region.
SADC, 1992. Declaration and Treaty of the Southern African Development Community.

Shannon, L.V. and M.J. O'Toole 1998 – An overview of the Benguela ecosystem. Collected papers, First Regional Workshop, Benguela Current Large Marine Ecosystem (BCLME) Programme, UNDP, Cape Town, South Africa, 22-24 July 1998: 20pp.

Stromme, T. 1996 –An overview of hake research undertaken in Namibian waters by the Dr Fridtjof Nansen Programme. In Proceedings of the Seminar and Workshop The Benguela Current and Comparable Eastern Boundary Upwelling Systems, Swakopmund, Namibia, May 1995: 100-107.

Stuttford, M. (ed.) 1998. Fishing Industry Handbook South Africa, Namibia, Mozambique. Marine Information CC. Stellenbosch: 438pp.

Sumaila, U.R. 1995. Irreversible capital investment in a two-stage bimatrix fishery game model. Marine Resource Economics, 10(3) 263 - 283.

Sumaila, U.R. and M. Vasconcellos 2000 Simulation of ecological and economic impacts of distant water fleets on Namibian fisheries. Ecological Economics, 32, 457-464.

Tapscott, C. 2001. An overview of the socio-economics of some key marine industries in the Benguela Current Region. A Report prepared on behalf of the Benguela Current Large Marine Ecosystem Project, Windhoek, October 1999.

UNDP (Undated). An integrated overview of fisheries of the Benguela Current Region. A report commissioned by the United Nations Development Programme (UNDP) as an information source for the Benguela Current Large Marine Ecosystem (BCLME) Programme

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MANAGEMENT OF SHARED FISH STOCKS - AUSTRALIAN CASE STUDIES

by

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Caton, A (in press), Fishery Status Reports 2000-2001, Resource Assessment of Australian Commonwealth Fisheries, *Agriculture, Fisheries and Forestry Australia, Bureau of Rural Sciences 252pp.*

INTRODUCTION

Australia is involved in the management of a number of potentially shared fish stocks, including transboundary stocks with neighbouring countries (Papua New Guinea and Indonesia), straddling stocks between the Australian Fishing Zone (AFZ) and the high seas (deep sea Orange Roughy stocks) as well as in several Regional Fisheries Management Organisations relating to highly migratory species. However to remain within the scope of the Expert Consultation, which is focusing on transboundary stocks and straddling stocks, Australia has prepared the following case studies that demonstrate a wide degree of divergence in terms of the political landscape, players involved and degree of success. These are:

- South Tasman Rise
- Arafura/Timor Sea fisheries
- Torres Strait fisheries
- Heard and MacDonald Islands

For each case study, the following are described:

The fishery
: A brief description of the present fishery

Fishery development
: Description of how the fishery developed, the players involved and involvement in shared management

Management arrangements
: Description of current management

Knowledge of the resource
: Scientific research and current knowledge on the stock structure, extent of the resource and sustainable yield.

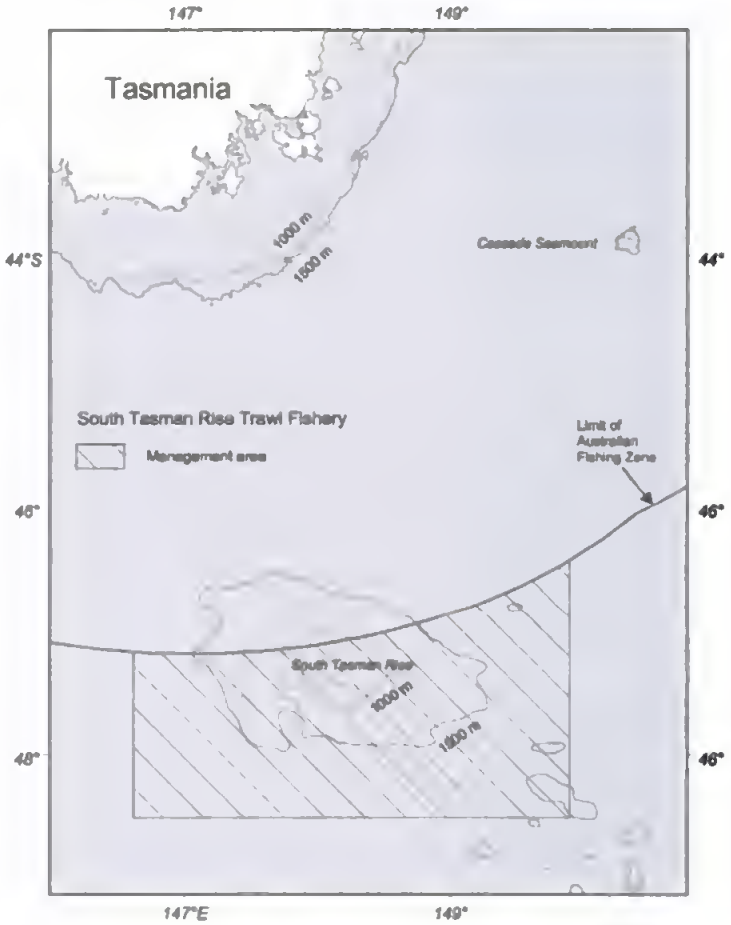
Management performance
: Brief comments of how the shared management arrangements are performing against the criteria given as part of the TORs for the Expert Consultation, including the mandate for management, political will, institutional arrangements and decision making process.

SOUTH TASMAN RISE TRAWL FISHERY

The Fishery

The South Tasman Rise is a large, submerged plateau due south of Australia and the island of Tasmania between 46°30'S and 48°30'S, an area that straddles the Australian Fishing Zone (AFZ). It rises to within 1000 m from the surface at its shallowest point. The portion lying outside the AFZ in the high seas is known as the South Tasman Rise Trawl Fishery. This is primarily a deepwater demersal trawl fishery, targeting orange roughy (*Hoplostethus atlanticus*), smooth oreo (*Pseudocyttus maculatus*) and spiky oreo (*Neocyttus rhomboidalis*). Fishing occurs throughout the year with the main catches being taken when orange roughy form large spawning aggregations in winter around the sea mounts at depths ranging from 800 to 1,000m.

Orange roughy are very vulnerable to fishing because of their low productivity and their propensity to form spawning aggregations in winter. They live for well over 100 years and have a very low natural mortality. They mature between 20 years and 30 years and fecundity is also very low.



Fishery Development

Although there has been sporadic exploratory trawling on the South Tasman Rise since the mid-1980s, catches were generally small and mainly of oreos. However, in late 1997, significant aggregations of orange roughy were discovered and the fishery rapidly increased and Australian vessels had landed over 1500 tonnes by the end of the year.

As the bulk of these fish were taken outside the AFZ, the fishery also attracted vessels from the New Zealand deepwater trawl fleet. During 1997, the two fleets made a total catch of over 2 000 tonnes of orange roughy and about 1100 t of oreos. Concern was expressed that uncontrolled fishing by both fleets would swiftly decimate the orange roughy population(s) of the rise. Fisheries officials from both countries agreed in late

1997 to establish a precautionary TAC for orange roughy within a proclaimed area of international waters encompassing the known fishery. The TAC level was based on the verified 1997 catch level (2100 t) and apportioned between the two countries accordingly (80 percent Australia, 20 percent New Zealand). The fishing year was split into two six-month periods, each with half the TAC, to encourage fishing over a longer period to obtain more information on the extent of the fishery. It was also agreed that a joint research project should investigate the stock-structure of orange roughy and attempt to assess the size of this resource.

The fishery has been harvested every year since, but in 2001–02, the catch was only 188 tonnes of orange roughy and 25 tonnes of oreos, one-fifth of the catch in 2000–01. Fishing effort also declined markedly from 1100 to 150 shots. For 2002–03, the TAC management zone was extended to include the area of the rise lying within the Australian EEZ. The global TAC was reduced from 2 400 tonnes to 1 800 tonnes. If 2002–03 catches remain low, a TAC reduction of much greater magnitude will be warranted.

Management Arrangements

Australia claims the right, under the United Nations Convention on the Law of the Sea, to manage the orange roughy fishery as a straddling stock, specifically paragraph 5 of Article 3 of the UN Fish Stocks Agreement which states "Where there is no subregional or regional fisheries management organization or arrangement to establish conservation and management measures for a particular straddling fish stock or highly migratory fish stock, relevant coastal States and States fishing on the high seas for such stocks in the subregion or region shall cooperate to establish such an organization or enter into other appropriate arrangements to ensure conservation and management of such stocks and shall participate in the work of the organisation or arrangement".

A formal Memorandum of Understanding (MOU) based on an agreed TAC was ratified in late February 1998 between the two countries to take effect from 1 March 1998. In February 1998, Australian vessels landed 2052 tonnes before either the MOU or the TAC took effect. Australia's allocation of the orange roughy TAC under the terms of the MOU was 1 669 tonnes; New Zealand's was 431 tonnes Because the second half of the fishing season would not start until 1 September 1998, a further 300 t were set aside as a research quota (150 tonnes Australia, 150 tonnes New Zealand) so that samples could be obtained during the July–August orange roughy spawning season.

The MOU expired on 28 February 1999 and was not renewed, due to disagreement between the parties. New Zealand claimed the Australian catch of 2 052 tonnes taken immediately before the MOU started was a breach of the spirit of the agreement. Australia in turn was concerned that New Zealand had exceeded its allocation during the period of the Agreement (175 tonnes—81 percent over the New Zealand TAC) and during the research cruise (66 tonnes—31 percent over the agreed limit).

To resolve the impasse, Australia agreed that New Zealand should have, on the basis of the 80 percent: 20 percent share, a one-off additional catch of 250 tonnes. Both countries agreed to cap overall catch at 2 100 tonnes. Australia undertook to manage its fleet on the basis of the old MOU. Both fleets started fishing again on 1 March 1999 the Australian Fisheries Management Authority (AFMA) closed the fishery to Australian vessels when their catch exceeded 1 700 tonnes. However, New Zealand was unable to stop its vessels, which caught more than 1 600 tonnes, bringing the total of orange roughy removals in 1999 to over 3 300 tonnes.

As a matter of urgency, the respective Fisheries Ministers agreed to several points of a proposed new arrangement, including an increased TAC of 2 400 tonnes, shared 75 percent (1 800 tonnes) to Australia and 25 percent (600 tonnes) to New Zealand. This new arrangement meant that New Zealand had already over-caught its quota by more than 1 300 tonnes. Although New Zealand accepted this figure, it did not agree with Australia that its quota should be backdated to 1 March 1999. Despite these difficulties, both countries agreed to close commercial target fishing for orange roughy on the South Tasman Rise until 29 February 2000. As Australian fishers had retained a small portion (60 tonnes) of their TAC to allow for orange roughy bycatch when targeting oreos, they were permitted to target oreos until the orange roughy TAC was filled.

Management of this fishery was further complicated by the appearance of three South African and one Belize-flagged freezer-trawlers in South Tasman Rise 'high-seas' waters during the 1999 winter-spawning season. Logbook records from the South African vessels showed them to have caught 750 tonnes of orange roughy from the rise, but as they also fished the newly discovered Madagascar Ridge orange roughy fishery en route back to South Africa, it is uncertain whether this was the true amount. Anecdotal reports from the fishing industry claim that close to 5 000 tonnes was taken. The quantity of fish caught by the Belize vessel

is also unknown, but an anecdotal report suggested it was about 1 200 tonnes. At that time, there was no legal basis to force foreign vessels to cease fishing. By law, Australia could only approach the flag-state of the vessels and request cooperation in managing this straddling stock. The approach is in line with obligations contained in the United Nations Law of the Sea Convention and the United Nations Agreement on highly migratory and straddling fish stocks. With the latter Agreement now in effect, Australia has a legal basis to exert greater control over the South Tasman Rise fishery.

Thus, while the total validated catch of orange roughy during the 1999–2000 'season' (in effect the 1999 calendar year) was 4420 tonnes (with Australia landing 2040 tonnes, New Zealand 1630 tonnes and South Africa 750 tonnes) it may have exceeded 10 000 tonnes if anecdotal reports are accurate.

Australia and New Zealand agreed on a new MOU ("Arrangements between the Government of Australia and the Government of New Zealand for the Conservation and Management of Orange Roughy on the South Tasman Rise") for the 2000–01 fishing year, coming into effect on the 1 March, replacing the previous 1998 MOU and settling two main areas of concern:

- A long-term management arrangement for the high seas area of the South Tasman Rise of 2 400 tonnes and split 75/25 between Australia and; and
- The dispute over catch of orange roughy from the fishery in past seasons, with New Zealand also agreeing to 'repay' 640 tonnes of its previous over-catch over seven years.

In early 2002, Australia and New Zealand conducted annual negotiations under the arrangement and as a result the TAC for the 2002-03 season was reduced from 2 400 tonnes to 1 800 tonnes in recognition that catches in the 2001-02 season were well below the 2001-02 TAC. In addition to the reduction in the TAC it was agreed that the Australian allocation of orange Roughy TAC under the arrangement now applies to the entire area of the South Tasman Rise geographical feature, both inside and outside Australia's EEZ. This is clearly a more precautionary approach than that taken previously.

Knowledge of the resource

While more research is required to assess the size of the resource and the extent of fish movement across the Australian Exclusive Economic Zone (EEZ) boundary, all available scientific evidence indicates that the current South Tasman Rise orange roughy fishery is based on a single discrete stock that straddles the Australian EEZ boundary. A joint Australian/New Zealand study during 1998 concluded that a common orange roughy stock straddles the Australian EEZ and that it might be distinct from the stock off eastern and southern Tasmania. The principal recommendation of a joint scientific workshop to discuss research findings, held in Wellington in December 1998, was that the current South Tasman Rise fishery should be managed as a single discrete stock.

Surveys of the spawning aggregations based on Australian industry funding have occurred in 2000, 2001 and 2002. A general monitoring survey was also conducted in 2000. The results of this research feed into the stock assessment process for orange Roughy for the STR. Precise estimates of the sustainable yield are not available, but recent massive declines in catches and catch rates are of concern. Further study is being undertaken with the aim of trying to establish the size of orange Roughy stocks on the STR Fishery.

Management performance

- **Mandate for management.**

The mandate for Australian management of the South Tasman Rise (STR) Orange Roughy fishery came from Australia's intention at the time the fishery was being developed to become a party to the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of The Sea and the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (the UN Fish Stocks Agreement).

- **Political will of national authorities and regional organisations to promote cooperative management.**

As a signatory to the UN Fish Stocks Agreement, Australia is bound to promote cooperative management arrangements for fisheries such as the STR. In recognition of this, Australia and New Zealand signed a Memorandum of Understanding on how the STR fishery was to be managed. In 2000, Australia and New Zealand negotiated and signed an arrangement entitled "Arrangement Between the Government of Australia

and the Government of New Zealand for the Conservation and Management of Orange Roughy on the South Tasman Rise" (the "2000 Arrangement").

Institutional arrangements and the capacity of national authorities and regional organisations to promote management.
The STR fishery management arrangements are clearly stated in the 2000 Arrangement where the responsibilities of both parties in the management of the STR fishery are set out.

- **Use of decision-making procedures and criteria for the allocation of shared resources based on transparent and equitable criteria.**

The 2000 Arrangement was drafted to ensure that the process for decision-making procedures for the STR fishery was clearly stated. With regard to the allocation of catch under the 2000 Arrangement, the allocation of resources was originally negotiated between the parties (Australia and New Zealand) as a tonnage allocation based on catch history during the period 1 January 1997 to 17 December 1997. This was further refined by the 2000 Arrangement whereby the Total Allowable Catch (TAC) was based on an administratively simpler and equitable percentage split.

- **Access provisions for new entrants, with respect to Article 63, paragraph 2 shared stock fisheries.**

The 2000 Arrangement was developed to allow cooperation with third countries that have a real interest in the management of orange Roughy on the STR and requires parties to consider Article 11 of the UN Fish Stocks Agreement ("New Members or Participants") with regard to third countries wishing to be a party to the arrangement.

- **Membership and participation rights that are based, inter alia, on harvesting interests as well as environmental interests (e.g. eco-system and biodiversity interests).**

The 2000 Arrangement has been developed with the long-term sustainability of the fishery as a clear objective. Parties to the arrangement have agreed to a program of scientific research, exchange of information and monitoring of party's vessels within the STR. The annual TAC is to be considered taking into account outcomes of scientific research.

- **Mechanisms for the sharing of fisheries management functions and responsibilities as well as the sharing of management costs; and**

The 2000 Arrangement requires a collaborative approach be taken to a program of scientific research, the exchange of information on catches and effort, and surveillance of third country fishing activity. These activities are undertaken by both parties simultaneously. The 2000 Arrangement has not been drafted to affect neither a sharing of management functions nor a sharing of the cost of management activities and responsibilities.

- **Prevention and elimination of IUU fishing activities.**

Due to the previous plundering of the STR by non-party interests at the expiry of the original MOU, the parties have committed, through the 2000 Arrangement, to cooperate in surveillance for and reporting of IUU fishing activities (those by parties not signatory to the 2000 Arrangement or by vessels of parties not authorized to fish there). Where fishing by a vessel of a third country threatens the effectiveness of the 2000 Arrangement, the 2000 Arrangement requires the parties to be proactive in approaching the flag state of a vessel from a third country seeking that country's cooperation in conservation and management arrangements for the fishery.

- **Conclusions.**

In short, the MOU worked insofar as it prevented unfettered exploitation by the Australian & New Zealand fleets and facilitated some research on the developing fishery. However, there was much debate over the TAC setting and allocation process and much 'bad-blood' between the respective industries. In hindsight, the TACs were set too high and the 1999 "illegal" fishing (the full quantum of which remains unknown) resulted in a rapid depletion of the roughy stock. Current indicators suggest a low remaining biomass and low future yields.

ARAFURA/TIMOR SEAS FISHERIES

The Fisheries

There is a large demersal fish resource in northern Australia, made up of a diversity of species. Relatively few of them are considered commercially important to Australian fishers. High costs of operating in a remote region and protracted delays in finalising Australia's Offshore Constitutional Settlement negotiations hindered development of finfish trawling. Currently one licensee targets the preferred species for Australian and overseas markets, namely, saddle-tail snapper or scarlet sea perch (*Lutjanus malabaricus*) and other large red snappers (*L. erythropterus*, *L. sebae*). A small demersal trap-and-line fishery also exists. The Timor Reef fishery, an annexed component of the demersal fishery targets mostly goldband snapper (*Pristipomoides multidens*) using baited lines and traps. The 1999 catch of the Timor Reef fishery was approximately 250 tonnes, valued at A$1.25m.

Although finfish trawling effort by Australian vessels in the region is low, the fact that stocks straddle the Australian and Indonesian fishing zones means that consideration must be given to the impact of fishing effort in both Australian and Indonesian waters, which has expanded rapidly over the past few years.

A significant shark resource also occurs in Australian northern waters, the principal commercial species being two species of black-tip shark (*Carcharhinus tilstoni* and *C. sorrah*). Hammerhead sharks (Sphyrnidae) and mackerels (principally grey mackerel, *Scomberamorus semifasciatus*) also form a significant part of the catch. Shark fishing takes place mainly in inshore areas across northern Australia. The major fishing method is pelagic gillnetting. Sharks are also often taken incidentally by handline, longline, haul net, bait net and barramundi fishing in northern Australia. There are also significant catches of shark from the Northern Prawn Fishery (NPF), which operates throughout much the same region as the northern shark fisheries. A study published in 1991 by the Northern Territory Department of Primary Industry and Fisheries showed an annual NPF catch of at least 100 t of black-tip shark. Restrictions in the NPF currently limit the amount of all shark species on board at any one time to 100 trunks or an equivalent of 250 kg of skinless fillet. Also, no more than 100 sets of shark fins are permitted on board. Approximately 3 t of shark fillet, 2 tonnes of shark fin and 800 kg of shark trunks were recorded on NPF logbooks in 1998.

Australia allows access by traditional Indonesian fishers to a limited area of the AFZ off northwestern Western Australia (the MOU Box). The extent of the catches taken by these vessels and by Indonesian vessels operating illegally in Australian waters is unknown. Indications are, however, that the species composition of the catch taken by Indonesian vessels is different from that taken by domestic shark vessels.

Development of the fishery

Foreign trawlers have fished the region for many years prior to establishment of the AFZ in 1979, and continued to do so under licence until 1990 when they were phased out to make way for expanding domestic interest. Several domestic finfish trawl licences were issued, but by 1995 only one active trawl licensee remained, the other licences having lapsed.

Sharks have also been fished commercially off northern Australia from the early 1970s. Between 1974 and 1986 a pelagic gillnet fishery was operated by vessels from Taiwan. Catches of shark and other pelagic species reached a peak of about 10 000 tonnes in 1977. With the declaration of the AFZ, a catch quota of 7000 t processed weight was implemented for a maximum of 30 licensed foreign gillnetters. Concerns about the incidental capture of dolphin saw a regulation introduced in May 1986 banning the use of gillnets longer than 2.5 km. At the time, the foreign vessels had been using gillnets up to 20 km long. The restriction effectively rendered foreign fishing uneconomic and, despite some attempts to switch to longlining as an alternative, the vessels from Taiwan had ceased shark fishing in the AFZ by mid-1986.

Australian gillnetters commenced direct involvement in about 1980, mainly in inshore waters close to Darwin. Remoteness from markets hindered expansion and only a small number of operators are active in these fisheries but there is considerable latent effort. The catch of this species declined to approximately 39 t in 1999–2000 from 65 t the previous year.

There is growing interest in shark fishing, and markets are developing for a range of shark products other than flesh, including fin, cartilage, liver and skin. Dried shark fin can fetch over A$250/kg on Asian markets.

Management arrangements

No formal management arrangements exist between the two countries apart from the MOU Box, which recognises that Indonesian line fishing vessels have traditionally fished in areas off northwestern Australia for a long period of time. Special arrangements have been made under a Memorandum of Understanding (MOU) between Indonesia and Australia for continued access to this limited area off Western Australia. However there is considerable concern about the status of target stocks and other natural resources in the MOU Box. Australia recognised that any options to address this issue must take account of the situation of traditional fishers and their need for an ongoing livelihood. Australia has proposed that Indonesia join with them in developing a management strategy for the Box. A MOU Box Management Committee has recently been formed further discuss the four themes: research; management measures; alternative livelihoods; and education and training.

For the remaining Arafura and Timor Sea areas, a number of informal meetings between Indonesian and Australian fishery managers and scientists have been held in an attempt to develop cooperative management arrangements. These were based on a *1992 Fisheries Cooperation Agreement* that is still in place. It was agreed in April 2002 to form a Working Group that would act as the main forum for fisheries and marine cooperation between Australia and Indonesia. It was noted that fisheries and marine issues had been discussed in a variety of different fora in the past, and that this WG should assume responsibility for these issues in the future. The Australia-Indonesia Ministerial Forum Working Group on Marine Affairs and Fisheries is a group of officials whose purpose is:

- To provide a forum for the discussion of marine affairs and fisheries issues that are of mutual interest and are related to the following themes:
  a) Poverty Reduction;
  b) Combating illegal, unreported and unregulated (IUU) fishing;
  c) Marine, coastal and small islands development and management;
  d) Marine and fisheries research;
  e) Fisheries management;
  f) Aquaculture;
  g) The marine environment;
  h) Marine biotechnology;
  i) Fishery products, safety, quality, product development and trade promotion;
  j) Education, training and capacity building; and
  k) Other marine cooperation.

- To facilitate practical cooperation on priority issues.
- To facilitate cooperation on commercial matters.
- To provide a progress report to the Australia-Indonesia Ministerial Forum, reviewing the effectiveness of cooperative actions.

Knowledge of the resource

A number of collaborative research projects have been undertaken by Australian and Indonesian marine scientists, including collaborative stock assessment for potentially shared red snapper, shark and tuna stocks. Past research by Australian scientists has established good baseline information in the MOU Box area, particularly on current biomass of a number of target species. Definitive information on the stock structure of the major finfish species, however, is not available, although a recent study indicates that at least one species, *Pristomoides multidens*, has significant genetic structuring both with Australian waters and between Australia and Indonesia. The Timor Sea is regarded as having a fish fauna distinct from that of the Arafura Sea but the extent to which Indonesia shares the fish stocks with Australia across the Arafura Sea is not known.

Rough estimates of annual sustainable yields based largely on survey data exist for the Australian portion of the Arafura Sea, and range between 3 700 tonnes and 6 800 tonnes, and for the Gulf of Carpentaria between 2 900 t and 9 000 tonnes The ranges incorporate large sampling variances for some of the survey data, and a range of values for the effective 'swept area' of the net. In October 1996 the Northern Territory Department of Primary Industry and Fisheries revised the sustainable yield for Arafura Sea red snapper to a more conservative level of 1 500 tonnes to 2 500 tonnes per year

Detailed genetic studies have been conducted for the shark species, *Carcharhinus tilstoni* and *C. sorrah*, on samples collected throughout the range of the fishery. The results of these studies indicated that there is only one population of each species in these waters, a conclusion supported by tag recaptures showing long-distance movements and indicating sufficient mixing and interbreeding to provide gene flow between widely separated areas. It is likely that Taiwanese gillnetters operating in Indonesian waters also fish the same stocks of shark. However, historical differences in catch rates of sharks between inshore and offshore fisheries, as well as some local spatial differences, suggest that spatial structuring is important.

It is thought that current catches of shark species in Australian waters are below estimates of sustainable yield, but the estimates are not particularly robust. The most recent estimate of sustainable yield for black-tip shark is at least 2 000 tonnes per year for the Northern Territory, Queensland and Western Australia fisheries combined. Catch rates have declined in this fishery since the 1980s and this may be attributable to foreign fishing, although it is also possible that declines in domestic catch rates have been due to slow depletion of an inshore, resident component of the overall stock.

Little consideration has been given to impacts of fishing on other species. The assessments of blacktip shark rely on parameters such as age, growth, mortality and reproductive capacity, which are estimated with varying degrees of uncertainty. The impact of catches taken by traditional Indonesian fishers in Australian waters is unknown. In addition, the significant catches of shark taken in Indonesian waters have an unknown impact on shark within the AFZ.

Recent surveys in the MOU Box have showed that high-value trepang and trochus are heavily depleted on most shallow reef areas. Lower value trepang stocks are also suffering depletion. It was also concluded that current fishing levels for sharks might be seriously depleting the reef shark population.

Management performance

- **Mandate for management**

Australia and Indonesia have yet to formalize any agreed cooperative management measures, apart from the MOU box.

- **Political will of national authorities and regional organisations to promote cooperative management**

Both Australia and Indonesia are keen to engage in cooperative engagements but funding is a problem – international aid will be important in the future to facilitate and implement the process. Although there is

good will between the two countries, the main constraints are the remote nature of the fishery to both Governments and the lack of appropriate resources to managing the fishery sustainably.

- **Institutional arrangements and the capacity of national authorities and regional organisations to promote management.**

The newly established Working Group on Marine Affairs and Fisheries will have an important role in promoting cooperative management.

- **Use of decision making procedures and criteria for the allocation of shared resources based on transparent and equitable criteria**

Not yet applicable.

- **Access provisions for new entrants, with respect to Article 63, paragraph 2 shared stock fisheries**

Not yet applicable, although Australia considers that the resources are fully utilized.

- **Membership and participation rights that are based, inter alia, on harvesting interests as well as environmental interests (e.g. eco-system and biodiversity interests)**

Not yet applicable.

- **Mechanisms for the sharing of fisheries management functions and responsibilities as well as the sharing of management costs**

Not applicable.

- **Prevention and elimination of IUU fishing activities.**

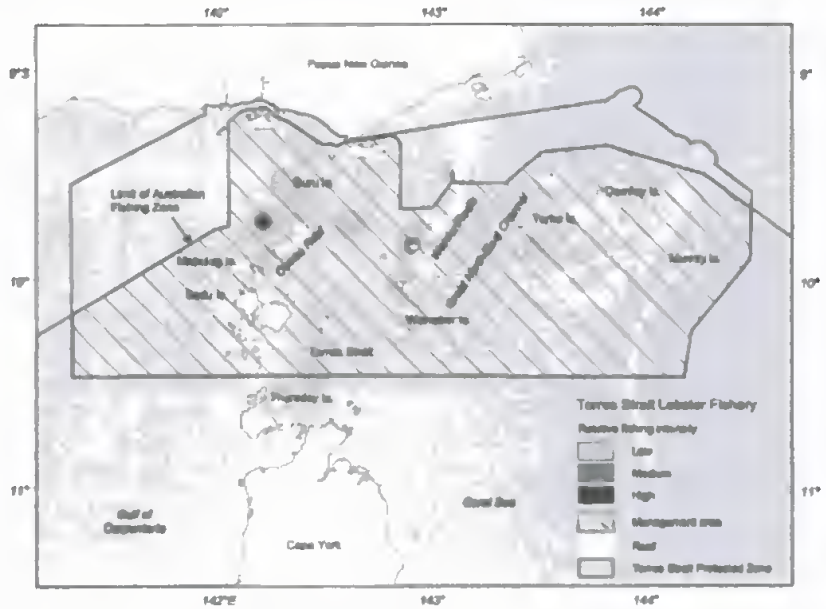
Australia is concerned about the scale and nature of illegal fishing in its northern waters. Illegal fishing in Australia's northern EEZ is mainly of Indonesian origin, and there is an average of about 80 apprehensions per year. The main area of apprehension is outside the MOU Box, and the species targeted is usually shark. Australia believes that the depletion of stocks in the MOU Box may lead fishers to travel into other areas of the Australian EEZ in search of fish and the MOU Box may provide a springboard for these activities. Indonesia has a similar problem with illegal fishing by traditional Filipino vessels in the Indonesian EEZ.

TORRES STRAIT FISHERIES

The Fisheries

Torres Strait is located between the tip of Cape York and Papua New Guinea and consists of over a hundred islands and reefs. Eighteen of these islands are currently inhabited.

Torres Strait is a biologically productive area, the waters of which yield large amounts of seafood for local consumption and for sale in Australia and overseas. Apart from food freighted in from the mainland, sea-based food is the staple diet of Torres Strait Islanders, as well as being central to traditional island culture. The Strait is culturally and strategically important to Australia and is also one of Australia's most vulnerable borders, especially in terms of quarantine.



Torres Strait Islanders are among the world's highest consumers of seafood. Dugong meat and turtle eggs are especially valued as food, and turtle meat is a staple source of protein in the central islands. Fishing for reef species and combing the reefs for animals that live there is also integral to Islander culture.

Commercial fishing is the most economically important activity in the region and provides the greatest opportunity for financial independence and stability of Islander communities. Fisheries operating in Torres Strait are:

- prawn trawling
- dugong and turtle hunting
- tropical rock lobster diving
- traditional fishing
- Spanish mackerel trolling
- finfish fishing (multi-gear)
- pearl shell diving and pearl farming
- trochus diving and gathering
- crab
- beche-de-mer gathering

Prawn Trawling

Prawn trawling is a major economic activity, carried out mainly by non-Torres Strait Australian fishers. The main prawn-trawling ground in Torres Strait is to the east of the Warrior Reef complex, centred on Yorke Island. Few vessels fish in Torres Strait exclusively; most have Queensland east coast licenses, and some are also licensed for the Northern Prawn Fishery. They move between fisheries in an attempt to maximise catch rates.

Annual catches since 1980 comprised 30–69 percent endeavour prawn and 29–61 percent tiger prawn. The red-spot king prawn (*Melicertus longistylus*), caught mainly near reefs, made up most of the remainder (1–5 percent). In 2000, the Torres Strait Prawn Fishery catch was 1 617 tonnes. A total of 78 vessels were licensed for Torres Strait and 75 of them fished. All but one were also endorsed for the Queensland east coast prawn fishery, and 17 were also endorsed to fish in the Commonwealth-managed Northern Prawn Fishery.

Seven trawlers licensed by Papua New Guinea may fish in Australian waters under a Torres Strait Treaty catch-sharing arrangement. However, only three have done so (after catches declined in the Gulf of Papua).

New management initiatives for the Torres Strait fishery were introduced in 2001: specifying a new boat-replacement policy; reducing the maximum length of net (combined headrope and footrope length of 88 m); and, from 2002, mandating the use of turtle-excluder and bycatch-reduction devices.

Dugong and turtle hunting

Hunting skills have been highly esteemed in Torres Strait Islander communities. Hunters would spear sea turtles or dugongs with a specially designed harpoon or *wap* from a platform built on a reef flat. Sea turtles were also caught from canoes with a remora, or suckerfish, tied by the tail and released near the turtle. The remora would attach to the turtle with its suckers and the turtle and canoe could be dragged together. Sea turtles were also captured on beaches when nesting.

Hunting remains a major traditional-fishing activity in Torres Strait, but is now almost always done from outboard-powered aluminium dinghies. In the three decades since the introduction of dinghies, hunters have modified their practices and increased the area covered. Hunters now chase turtles from the dinghies and either harpoon them or jump into the water to grab them. Turtles are also simply overturned on beaches as they crawl up to nest. These methods do not require the planning and skill of earlier hunting methods and do not attract the same community status.

There are six species of sea turtles found in Torres Strait—green, hawksbill, loggerhead, flatback, olive ridley and leatherback (which is rare). All species of marine turtles in Australia are listed in appendix I of the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). The International Union for the Conservation of Nature (IUCN) lists leatherback, green, hawksbill and olive ridley turtles as endangered, and the loggerhead turtle as vulnerable.

The dugong or sea cow, *Dugong dugon* is found around coastal northern Australia from Shark Bay to Moreton Bay. Commercial hunting of dugong is prohibited in both Australia and Papua New Guinea, but the indigenous inhabitants of both countries may hunt them for non-commercial use. The flesh of pregnant females is prized for its high fat content, and the unborn calves are a special food for the very old and the very young.

Along with the manatees, the dugong is listed in the IUCN *Red Book of Threatened Species* as vulnerable to extinction. The dugong is also listed as a vulnerable species under the regulations associated with the *Nature Conservation Act 1992* (Queensland) and is listed in CITES appendices.

Tropical rock lobster diving

As tropical rock lobsters do not enter baited traps, these are mostly taken by divers with spears. However, an increasing number of lobsters are now being caught live with hand-held scoop nets, either by diving or by

reef walking with lamps at night. Divers generally work in pairs from small dinghies and either free-dive or use a 'hookah' that supplies compressed air from the surface. Free divers generally work in waters to about 4 m deep, while hookah divers work in waters to around 20 m. Between 300 and 500 dinghies and 15 small freezer boats are used in the combined Australian and Papua New Guinea Torres Strait Lobster Fishery.

Mackerel trolling

Mackerel is the target of a small commercial fishery in Torres Strait and an important source of income for some Islanders. Traditional fishermen also take a subsistence catch of around 10 t a year. The fishery targets the narrow-barred Spanish mackerel (*Scomberomorus commerson*), but school mackerel (*Scomberomorus queenslandicus*) and double-lined or shark mackerel (*Grammatorcynus bicarinatus*) are also caught.

Finfish

The Torres Strait Finfish Fishery is a multi-species, multi-gear fishery targeting a variety of reef and inshore fish. The line-fishing sector focuses, in particular, on coral trout (*Plectroponus* spp.); mackerels other than Spanish mackerel; various reef fish (*Lutjanus* spp. and *Lethrinus* spp.); and numerous species of rock cods (*Epinephelus spp.*). Only traditional inhabitants may participate in the fishery. A total of 57 Torres Strait Islander vessels are presently licensed for the fishery. Finfish in the line-fishing sector are taken by hand-held lines, fishing rods or mechanically operated reels and lines. The fishery is expected to grow in the future, as there is continuing demand for these well-regarded food fish. The net-fishing sector is catching mainly barramundi (*Lates calcarifer*), mullet (*Mugil* spp.) and king salmon (*Polydactylus sheridani*), using gill, seine, bait or set nets.

Pearl shell diving

The pearl oyster (*Pinctada maxima*; commonly known as the goldlip or silverlip mother-of-pearl shell) and, to a very minor extent, the blacklip mother-of-pearl (*P. margaritifera*) are the species fished in Torres Strait. Another five species—*Pinctada albina, P. chemnitzi, P. fucata, P. maculata* and *P. albina sugillata*—also occur in the area.

Historically an important fishery in the area (see Development of the Fishery) but participation in the fishery has been low since the late 1980s and the 1990s, partly a result of high mortality rates of shells during transport from pearling grounds to the farms, and partly because most boats licensed for pearl shell are also licensed for tropical rock lobster, which is much more profitable and easier to handle. Encouragingly, adoption of on-board handling protocols that promote cleanliness and speed in transporting live shell has cut the post-harvest mortality level markedly in the last few seasons.

Trochus

The Torres Strait Trochus Fishery is a small, single-species commercial and subsistence fishery. Trochus (*Trochus niloticus*), also known as top shell because of its shape when upturned, is collected for shell and, to a lesser extent, for its meat. The shell, like mother-of-pearl, is used mainly for buttons and fashion accessories. Trochus is usually taken by free diving, although SCUBA and hookah are also used

It is an important source of income for some Islanders, especially women and children. The level of participation in the fishery is low at present, largely due to a recent decline in overseas markets for shells to make buttons. The fishery was historically important between 1920 and 1950 and again in the 1970s and 1980s. Effort in the fishery is strongly influenced by market forces.

The taking of trochus is restricted to hand-collection and the use of hand-held, non-mechanical implements, but the use of underwater-breathing apparatus is permitted. A minimum-size limit of 80 mm and maximum-size limit of 125 mm applies to all fishing (except for traditional use).

Crabs

The Torres Strait Crab Fishery targets mainly mud crabs (*Scylla* spp.) although a small quantity of blue-swimmer crab (*Portunus pelagicus*) is also retained as by-product. Crabs are harvested with pots and dillies.

Beche-de-mer

The Torres Strait Bêche-de-mer Fishery is also an important commercial fishery to Torres Strait Islanders. Its main catch was sandfish (*Holothuria scabra*) in the recent past, but harvesting of this species has been discontinued. Current fishing effort focuses on other bêche-de-mers: surf redfish (*Actinopyga mauritiana*), black teatfish (*Holothuria nobilis*), white teatfish (*Holothuria fuscogilva*) and, to a lesser extent, a couple of lower-value species.

Development of the fisheries

Islanders and other indigenous groups around Torres Strait have hunted sea turtles for meat and for ceremonial purposes before documented history. Hunting green turtles for meat and collecting the eggs of various turtle species were traditional forms of exploitation identified by the early anthropological studies of the Torres Strait Islanders. The Islanders still hunt turtles as part of their traditional-fishing activity, and turtle fishing is specifically cited for protection under the Torres Strait Treaty.

The pearling industry in Torres Strait has a long history. In the early part of the twentieth century, collecting mother-of-pearl shell was the chief industry in Torres Strait. Thursday Island was the focal point for the Queensland pearling industry, which supported over 350 boats and 2500 people at its peak in 1904.

In 1931 the market for pearl shell collapsed. Resurgence after the Depression was soon interrupted by the outbreak of the Second World War, and even though there was an upturn in the market after the war, the industry declined again within a decade. The death knell for the pearl-shell industry, as it was for trochus fishing, was the introduction of plastics, which replaced mother-of-pearl shell for the manufacture of buttons and other items.

In 1956, in response to increased Japanese pressure to fish for pearl shell in Australian waters, the Commonwealth Fisheries Office surveyed the pearling beds of northern Australia to support the development of a local pearl-culture industry. By 1971 there were seven pearl-culture farms in Torres Strait, employing 300 people.

The pearl shell industry started collecting live shells for the farms, thereby stimulating a partial recovery of the industry. Between 1990 and 1995 the annual take of live pearl-shell from Torres Strait ranged from 13 000 to 39 000 shells. Data collection in this fishery is difficult because lobster fishermen take much of the catch opportunistically. An annual survey of Torres Strait pearl-shell fishermen was introduced in 1993 to replace the voluntary logbook system and obtain a more complete picture of the number of live pearl-shell collected.

The commercial tropical rock lobster fishery in Torres Strait began in the late 1960s. The annual catch of tropical rock lobster by Australian divers in Torres Strait and North Queensland waters between 1970 and 1980 ranged between 68 tonnes and 124 tonnes of tails, about 15 percent of which came from the east coast of Cape York. Catches between 1981 and 2000 ranged from 130 tonnes to 350 tonnes and averaged 199 tonnes. The average Australian catch over the past 10 years was 195 tonnes, and in Papua New Guinea was 79 tonnes. Annual catches trended upwards through the 1990s, but dropped dramatically in 1999 and 2000 down to the low levels of the early 1990s.

The prawn trawl fishery in Torres Strait began in the mid-1970s, extending the prawn fishery of the Queensland east coast. When the Torres Strait fishery began, all east coast and Northern Prawn Fishery prawn trawlers were entitled to fish in Torres Strait, effectively allowing access to 1500 vessels. When the Torres Strait Treaty was ratified in 1985, the Torres Strait Prawn Fishery became separate from the east coast fishery, and an effort-reduction strategy was adopted. Further arrangements to reduce effort were introduced in 1993: each prawn trawler was allocated a quota of access-days—transferable between license holders—that limited its total time in the fishery in a season. The restructuring of the fleet resulting from the management regime was consistent with the Treaty aim of conserving Torres Strait prawn stocks, taking optimal catches and maximising economic efficiency.

Management arrangements

The Torres Strait Protected Zone Joint Authority, under an international treaty between Australia and Papua New Guinea, manages most of the Torres Strait fisheries. In 1984 the Australian and Papua New Guinea governments ratified the Torres Strait Treaty, which came into effect in February 1985 and the Australian Government passed the Torres Strait Fisheries Act 1984 that gave effect, in Australian law, to the fisheries elements of the Treaty. The treaty gives very clear guidance as the objectives of fisheries management in the Torres Strait - in particular the protection of the traditional way of life and livelihood of the traditional inhabitants, including their traditional fishing. The Torres Strait Treaty requires both Australia and PNG to cooperate in the conservation, management and optimum utilisation of the commereial fisheries of the Torres Strait Protected Zone (TSPZ). The Treaty also defined jurisdiction over islands and areas of sea in the zone, and of the fisheries and seabed resources. Under the Treaty arrangements for Australian waters, the Commonwealth and Queensland governments managed some fisheries jointly and solely Queensland managed others. On 1 April 1999, TSPZ fisheries that were Queensland-managed—including finfish, crab, trochus and bêche-de-mer—were placed under Joint Authority management.

Under Articles 22 and 23 of the Treaty, arrangements have been put in place to allow for sharing of the catch on both sides of the border. A 3-year agreement covering the period 7 March 1997 to 6 March 2000 provided for:

- 7 Papua New Guinea vessels to fish for prawns in the Australian sector of the TSPZ;
- 5 Australian vessels (3 at any one time) to take pearl shell in the Papua New Guinea sector of the TSPZ;
- 27 Papua New Guinea dinghies and their associated freezer boats to take tropical rock lobster in the Australian sector of the TSPZ;
- 10 Papua New Guinea dinghies and their associated freezer boats to take Spanish mackerel in the Australian sector of the TSPZ;
- monitoring and taking of dugong for traditional purposes; and
- monitoring and taking of turtle for traditional purposes in Australian waters and artisanal purposes in Papua New Guinea waters.

Following receipt of vessel nominations from PNG, endorsements were issued by Australia for PNG vessels in September 1998 for the following fisheries:

- 1 vessel to fish for prawns;
- 27 dinghies and their associated freezer boats to take tropical rock lobster; and
- 7 dinghies and their associated freezer boats to take Spanish mackerel.

Management of Torres Strait fisheries has been very well supported by research, as there has been a dedicated Australian research fund operating under the TSPZ Joint Authority since the ratification of the Torres Strait Treaty in 1985. Queensland has also contributed throughout that period. Research and management are overseen by a committee drawn from Islanders, industry and the Commonwealth and Queensland governments.

The number of fishers, the variability of participation in the fisheries, and the activities of Papua New Guinean coastal fishers make management of the artisanal and small-scale commercial fisheries in Torres Strait very difficult. With the recent change in management responsibility, with jurisdiction over all fisheries now lying with the TSPZ Joint Authority, a more structured approach to research and management will be possible, and data on which to base management are expected to become more reliable.

The TSPZ Joint Authority has established a working group to examine the long-term management needs for the rock lobster, line and mackerel fisheries.

Knowledge of the resource

Prawn Trawling

The estimated long-term sustainable yield for the fishery is 1900 t per year: 680 tonnes of tiger prawns, 1 035 tonnes of endeavour prawns and 185 tonnes of king prawns. The catch varies from year to year because of variable recruitment and changes in fishing effort. Current stock assessment results indicate that the average annual catch of tiger prawns in Torres Strait since 1991 (656 tonnes) approximates the maximum sustainable yield (MSY).

Prawn trawling in Torres Strait also takes a wide range of commercial byproduct species, including Moreton Bay bugs (*Tenus orientalis*), scallops (*Amusia pleurocentesis*), and several species of squid, finfish and shark. In July 1999, the Torres Strait Protected Zone Joint Authority endorsed a bycatch action plan for the Torres Strait Prawn Fishery, and in late 2001 agreed to mandate the use of bycatch-reduction devices (including turtle-excluder devices) from the start of the 2002 season. A number of Torres Strait fishers collaborated with researchers from the Queensland Department of Primary Industries Southern Fisheries Centre to trial the devices.

Dugong and turtle hunting

The dugong is long-lived (about 70 years). It matures between 9 and 17 years old, producing a calf after 13 months' gestation and suckling for at least 18 months. The period between calving is 3–7 years. Dugong therefore have a high investment in each offspring. Population simulations indicate that, even with the most optimistic combinations of life-history parameters, a dugong population is likely to increase at less than 5 percent per year.

The Torres Strait dugong population size was estimated by aerial survey in November 1987, November–December 1991, and November 1996. All surveys covered the western and central waters of Torres Strait and adjacent coastal waters of Cape York north of 10°52'S. The population estimate obtained from the 1996 survey was not statistically different from the 1991 estimate. These results suggest that the dugong population in Torres Strait was stable during 1991–96 and that the dugong harvest was sustainable for those years.

The levels of turtle harvest, based on best estimates over the last two decades, indicate neither an increasing nor decreasing trend in the catch. Estimates made in the mid-1970s, in the mid-1980s and in the 1990s indicate that the catch of sea turtles on the Australian side of Torres Strait has remained in the range of 2000 to 4000 turtles per year.

Tropical rock lobster diving

Since the peak Australian dive catch of 349 t tail weight in 1986, annual catches by the Australian dive sector have been around 200 tonnes In the 1990s they were generally higher than those before 1986 and close to the overall average. The 1999 and 2000 catches were exceptions, dropping to the low levels of the early 1990s.

Based on annual surveys and recruitment modelling, it was concluded in 2000 that the stock is probably biologically overfished. It was recommended that management action should be taken to ensure that fishing mortality does not increase unless further research indicates that an increase is defensible.

Mackerel trolling

Available evidence suggests there are two genetically distinct northern and eastern stocks of Spanish mackerel in Australia. The former, in Torres Strait and the Gulf of Carpentaria, is part of a northern stock distributed from the southern Gulf of Papua to Western Australia. The eastern stock occurs off eastern Queensland and New South Wales.

Catches average around 100 t of fillets annually, almost all taken from northeastern Torres Strait. While there is wide monthly variation, with catch rates generally higher in the second half of each year, the annual rate has remained stable between 1988 and 2000.

Bêche-de-Mer

Bêche-de-mer are easily overfished because they are large, easily seen and collected, and do not require sophisticated fishing techniques. As a result, the Torres Strait Bêche-de-mer Fishery is subject to a suite of input and output controls aimed at preventing overfishing but also allowing Islanders to benefit from the use of bêche-de-mer stocks.

The findings from the most recent survey resulted in a continued closure for sandfish. Experience elsewhere in the Pacific is that overfished bêche-de-mer stocks may take years to recover. This is because holothurians, like many other invertebrates, are broadcast spawners, so fertilisation success is highly dependent on population density. Consequently, reduction of population densities may result in too few eggs to rebuild the population.

Hatchery-propagation of sandfish has been developed by the International Center for Living Aquatic Resources Management (ICLARM) in the Solomon Islands. Reseeding sandfish stocks with hatchery-produced juveniles is now being considered as a way to assist stock recovery on Warrior Reef.

The status of black and white teatfish, surf redfish and other lower-value species remains unknown at present. These species may become the target of increased fishing pressure in future, as the export market for quality bêche-de-mer is growing.

Regulations in the fishery include: limiting the method of taking bêche-de-mer to either gathering by hand, or gathering by hand-held, non-mechanical implements; banning the use of hookah gear; limiting dinghy size to 7 m; having a competitive Total Allowable Catch (TAC) for commercial species; and imposing a limit on the minimum size of animals in the catch.

Management performance

- **Mandate for management**

The Torres Strait Treaty gives a very clear mandate for management and sets out very clear objectives of management and the main beneficiaries.

- **Political will of national authorities and regional organisations to promote cooperative management**

The Protected Zone Joint Authority is mandated to regard to the rights and obligations conferred on Australia by the Torres Strait Treaty,

- **Institutional arrangements and the capacity of national authorities and regional organisations to promote management.**

The Protected Zone Joint Authority works effectively to promote the objectives laid out in the Torres Strait Treaty. There are now formal institutional arrangements for PNG/Australian cooperative management but regular meetings are held to implement the catch sharing arrangements specified in the Treaty.

- **Use of decision making procedures and criteria for the allocation of shared resources based on transparent and equitable criteria**

Under Articles 22 and 23 of the Treaty, arrangements have been put in place to allow for sharing of the catch on both sides of the border. Arrangements are negotiated based on the degree of interest by both participating countries.

- **Access provisions for new entrants**

When the management arrangements for PZJA fisheries first came into effect in 1985, transferable licences were issued to persons who were not traditional inhabitants if they could demonstrate the required prior history and commitment to fishing in Torres Strait. Since then, new licences have only been issued to traditional inhabitants. In different fisheries a number of provisions have also reduced licence holdings by non-traditional inhabitants over time.

People who are not traditional inhabitants and wish to obtain a licence for a fishery in Torres Strait must buy one of the transferable licences from an existing operator. These licences are subject to strict boat replacement regulations limiting vessel size. Traditional inhabitants can enter any commercial fishery by obtaining, at a nominal cost, the appropriate fishing licence or by belonging to a community, which has authority for the desired fisheries;

- **membership and participation rights that are based, inter alia, on harvesting interests as well as environmental interests (e.g. eco-system and biodiversity interests)**

The Torres Strait Treaty requires each party to take legislative and other measures to protect and preserve the marine environment in and in the vicinity of the Torres Strait Protected Zone. In formulating these measures each party must take into account internationally agreed rules, standards and recommended practices, which have been adopted by diplomatic conferences or by relevant international organizations;

- **mechanisms for the sharing of fisheries management functions and responsibilities as well as the sharing of management costs; and**

Australia and PNG have a diplomatically appointed Joint Advisory Council that addresses many Treaty issues including fisheries monitoring, catch sharing, fisheries management and community-based management of traditionally utilised resources;

- **prevention and elimination of IUU fishing activities.**

The Surveillance and Enforcement Program undertaken by the Australian Fisheries Management Authority concentrates on four major activities:

Education/Extension;

Promotion/Development;

Information/Intelligence gathering; and

Enforcement/Policing

The objectives of the Program are as follows:

To carry out surveillance and enforcement duties to support the legislation and the policies of the PZJA;

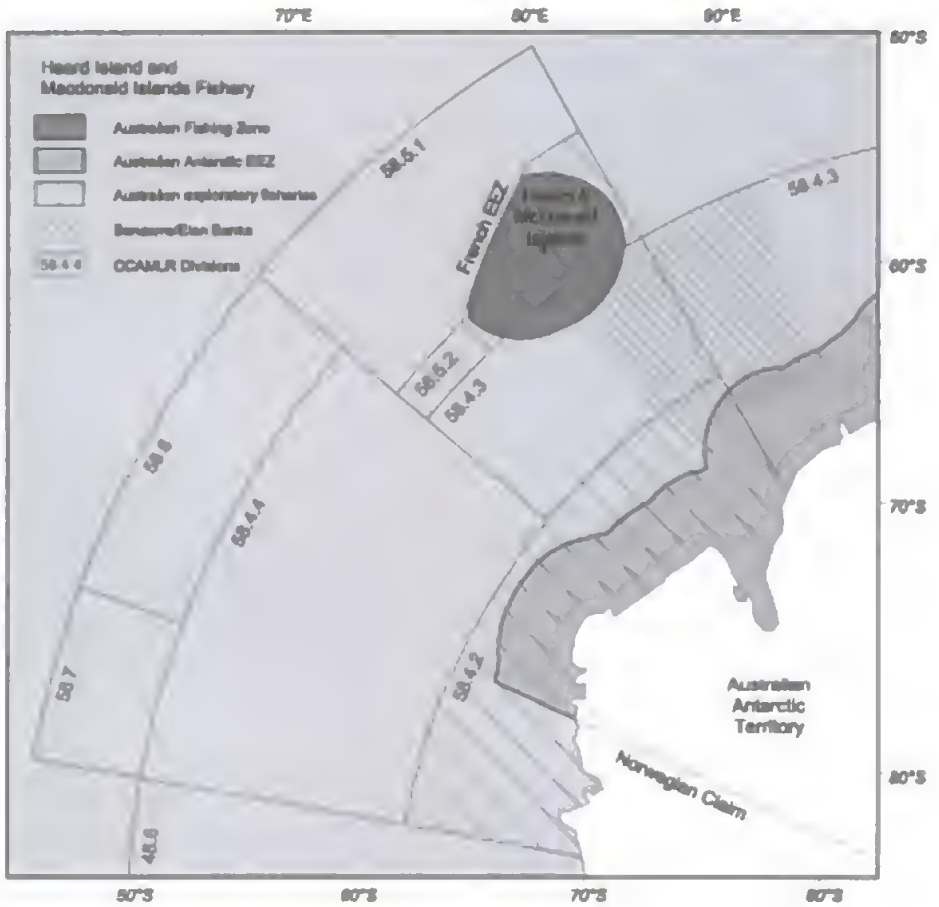
To provide an education and extension service for both traditional and commercial fishers to enhance the development and management of the fisheries within the TSPZ; and

To undertake such duties as required by the PZJA to protect the resources of the TSPZ and to promote their exploitation by persons permitted to utilise those resources in keeping with the spirit of the Treaty between Australia and PNG.

HEARD ISLAND AND MCDONALD ISLANDS FISHERY

The Fishery

Heard Island and McDonald Islands are Australian external territories, lying in the southern Indian Ocean about 4 000 km southwest of Perth. They have been described as the only example of an unmodified sub-Antarctic island ecosystem and are included on the Register of the National Estate and the World Heritage List because of their outstanding biological, geological and scientific values. The islands and their surrounding territorial waters (out to 12 n.mile) form the Heard Island Wilderness Reserve, which is managed under a formal Management Plan by the Australian Antarctic Division. The Management Plan prohibits commercial fishing within this 12 n.mile zone. Waters between 12 n.mile and 200 n.mile are part of the Australian Fishing Zone (AFZ) and fall under the jurisdiction of the Australian Fisheries Management Authority (AFMA). The AFZ abuts directly to the French EEZ.



The two Australian vessels operating in 2000–2001 made seven trips to the region. The total catch of toothfish was 2 988 tonnes and that of icefish from the fishery were at their highest recorded level, with 1 149 tonnes being taken.

FAO catch data suggest a very large catch (9 469 tonnes) from FAO Statistical Area 51 in the Indian Ocean and where previous reported toothfish catches were insignificant. Detailed scientific and other scrutiny has concluded that most of these catches were probably taken illegally from within the EEZs of France and Australia, and were fraudulently misreported.

Development of the fishery

Although substantial catches of notothenid (Antarctic cod) and channichthyid (icefish) fish have been taken since the early 1970s by Soviet, French and Ukrainian vessels on the adjacent Kerguelen plateau, there was very little fishing around Heard Island and the McDonald Islands until quite recently. Some Soviet fishing probably took place in the early 1970s and there was some Polish exploratory fishing in 1975.

Following a joint Soviet–Australian exploratory fishing expedition in 1987, Australia mounted a series of exploratory cruises between 1990 and 1993 on the Australian Antarctic Division's research vessel *Aurora Australis*. The cruises assessed the abundance and distribution of fish stocks in the AFZ, finding commercial quantities of Patagonian toothfish (*Dissostichus eleginoides*) and mackerel icefish (*Champsocephalus gunnari*). However, the biomasses for these species, estimated by a swept area approach, were much lower than those calculated for the neighbouring Kerguelen plateau and, in the case of icefish, were seasonally and spatially variable.

Management arrangements

As the islands lie to the south of the Polar Front (Antarctic Convergence), they also fall under the jurisdiction of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). The Commission, comprising 23 member nations, seeks to manage the Southern Ocean Antarctic ecosystem cooperatively. Its objective is the conservation (including the rational use) of Antarctic marine living resources. The Heard Island and McDonald Islands Fishery refers to the portion of the AFZ that falls within the CCAMLR Division 58.5.2. In addition, the area to which the *Fisheries Management Act 1991* applies has been extended to give AFMA responsibility for managing fishing by Australian vessels in the high seas area of Division 58.5.2.

AFMA released the *Heard Island and McDonald Islands Fishery Management Policy 1998–2000* in February 1998 allowing for a maximum of two permits. The Management Policy is amended each year to incorporate the decisions of the annual meeting of CCAMLR, particularly with regard to TACs and bycatch provisions. It is envisaged that a formal Management Plan will be implemented in 2002. Under the proposed plan, management would be by way of a system of transferable quotas, issued as statutory fishing rights, and with the specification of a minimum quota holding (25.5 percent of the total) before an operator may fish. Amongst other conditions, retention of quota in the fishery would require completion of a specified amount of research annually.

The remainder of the AFZ around Heard and McDonald Islands (the southern segment) falls within the CCAMLR Division 58.4.3 and is managed by AFMA under separate arrangements. Under the *Antarctic Marine Living Resources Conservation Act 1981*, the Australian Antarctic Division is responsible for administering Australia's harvesting of Antarctic marine living resources in the remaining high seas areas of the CCAMLR area, and has a primary role in coordinating Australian fisheries research and assessments in this area.

Illegal fishing in CCAMLR Divisions has been a serious problem. The Commission estimated that 10 000 t to 18 000 tonnes of toothfish were taken illegally in Division 58.5.2 in 1997 and a further 520 tonnes to 3 500 tonnes in 1998. At least some of this illegal catch was likely to have been taken in the AFZ. The reduction between 1997 and 1998 may have been due in part to surveillance and enforcement action taken by Australia and other countries, but also reflected a drop in price resulting from oversupply. Despite the reduction in the size of the illegal catch, CCAMLR was still concerned about the threat it posed to toothfish stocks and seabirds. It agreed to a number of counter-measures, in particular the mandatory use of automated, satellite-based vessel monitoring systems. In addition, the October 1999 meeting of CCAMLR agreed to introduce a certification scheme so that only certified catches of toothfish could be imported to the markets of CCAMLR parties.

Boats must carry two observers on every trip. In addition to monitoring compliance with permit conditions, the observers collect basic fisheries data and environmental and ecological information, including observations on seabirds, marine mammals and bycatch. They also tag fish and collect data and material for specific research programs (for example, genetic studies). CCAMLR also imposes specific data provision requirements on the fishery, including the reporting of catch and effort information every 10 days.

Knowledge of the fishery

Patagonian toothfish live around most sub-Antarctic islands and submarine plateaus. As these areas are separated by large expanses of abyssal basins these may tend to inhibit interehange of fish. Preliminary results from genetic studies combined with tagging information suggest there is little interchange of fish between fishing grounds. Toothfish are found on the shelf and upper-slope areas at depths of 300 m to more than 2000 m. They are large, active predators, maturing at about 70–110 cm (6.5–8 years) and growing to more than 2 m and 100 kg in weight. Their maximum age is now thought to be at least 40 years. Their diet is mainly mid-water squid and fish, but benthic animals such as prawns, crabs and echinoderms have been recorded in the diet regularly enough to indicate that bottom feeding is also important. Individuals appear to feed infrequently. Fecundity is moderate.

Mackerel icefish are found along the Scotia Are from Shag Rocks and South Georgia in the north, to west of Adelaide Island (Antarctic Peninsula) in the south, around Bouvet Island and on the Kerguelen–Heard Plateau. They are a shallow-water shelf species, found mainly between 100 m and 350 m, but known to occur as deep as 700 m. The maximum length ranges between 45 cm and 66 cm and maximum ages between 5 and 15 years, depending on the location. Fecundity is high. A separate population of icefish (characterised by a different breeding season and length distribution) occurs on Shell Bank on the eastern edge of the Heard Island Plateau. Owing to the small size of this population, no commercial exploitation of it is allowed.

Yearly stock assessments are carried out by the Australian Antarctic Division that feed into the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) stock assessment process that prescribes TACs for Division 58.5.2.

Since 1991, CCAMLR has adopted objectives for the maintenance of exploited fish stocks in terms of their abundance relative to their pre-exploitation abundance. CCAMLR requires that abundance remain sufficiently high to avoid the likelihood of declining recruitment and to meet the needs of dependent species (usually predators). Criteria initially developed for krill have been applied to toothfish and icefish. For toothfish, the catch limit must be chosen so that over a 20-year period:

- the probability of the spawning biomass dropping below 20 percent of its pre-exploitation median level is less than 10 percent; and
- the median spawning biomass remains at or above 50 percent of its pre-exploitation median level.

For icefish, the second criterion is set at 75 percent of its pre-exploitation median level because icefish have been found in the diet of a number of predator species in the area.

A stock projection model is used to determine TACs that satisfy the CCAMLR criteria. To generate stock trajectories over the required period, the model uses basic biological information on the species together with estimates (derived from trawl surveys) of recruitment and its variability. Uncertainty in the input data can be taken into account explicitly. This generalised yield model was initially developed for krill, but has been adapted for use with toothfish, icefish and other Heard Island and McDonald Islands stocks.

A precautionary TAC of 311 t was set for icefish in Division 58.5.2 in 1995 in response to Australia's request to CCAMLR for a new trawl fishery. The TAC for icefish was re-evaluated after the 1997 pre-recruit survey. Because there is evidence of at least two separate stocks, based on differences in spawning time and size structure, their status was assessed separately. The TAC for the Heard Island Plateau was set at 900 tonnes. Despite the Scientific Committee of CCAMLR recommending that directed fishing for icefish be avoided in the other known area, Shell Bank, because of low abundance, CCAMLR did not explicitly restrict fishing in this area. Australia chose to close this area to fishing.

Potential yields of toothfish in Division 58.5.2 were derived in 1994 and 1995. The 1996 assessment used an improved version of the generalised yield model and new recruitment estimates to obtain a TAC of 3 800 tonnes. This was considerably higher than the previous TAC of 297 tonnes. CCAMLR's second criterion (the one designed to maintain dependent species) is the limiting criterion for toothfish. A catch of 3800 t easily satisfies the first criterion, with a probability of 4 percent of falling below 20 percent of the pre-exploitation median. The 1997 TAC was set at 3 700 tonnes after taking into account the estimated catches from illegal as well as legal fishing.

The toothfish assessment was updated in 1998 using the latest version of the generalised yield model, a revised estimate of the 1997 illegal catch, the upper estimate of the 1998 illegal catch and an assumption that high illegal catches do not continue. The long-term annual yield was calculated as 3 690 tonnes. A short-term annual yield was calculated for mackerel icefish by the same method as in 1997 and the results of the 1998 pre-recruit survey. Although the estimate of biomass on the Heard Island Plateau was lower than in 1997, the calculated yield increased to 1 160 tonnes because of a reduction in uncertainty.

A random, stratified survey of toothfish was undertaken on the Heard Island Plateau in March–April 1999. This survey collected comparable data to the early 1990s surveys. The dataset, along with commercial fishing data, was used to update population parameters including recruitment, growth, biomass and stock structure. The results indicated much greater year-to-year variability in recruitment than previously thought and a slower-growing, longer-lived population on the Heard Plateau than in South Georgia. The results were used in the generalised yield model, producing a revised long-term yield estimate of 3 585 tonnes.

Regular surveys of the fishery continue to be undertaken by commercial vessels under the direction of the Australian Antarctic Division. This research has lead to further refinements to the stock assessment models and 2000–01 season TACs of 2 995 tonnes for toothfish and 1 150 tonnes for icefish.

Management performance

- **Mandate for management.**

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) provides a sound mandate for management. This along with Australian Fisheries management Authority's legislation and management plans provides a sound basis for the management of legal catches. The Commission, comprising 23 member nations, seeks to manage the Southern Ocean Antarctic ecosystem cooperatively. Its objective is the conservation (including the rational use) of Antarctic marine living resources.

- **Political will of national authorities and regional organisations to promote cooperative management.**

As demonstrated by the very strict control placed on the development and operation of the Australian fishery, along with their active participation in CCAMLR there is a strong political will from Australia to manage the fishery sustainably.

- **Institutional arrangements and the capacity of national authorities and regional organisations to promote management.**

CCAMLR provides a strong institutional basis on which to manage cooperative parties.

- **Use of decision making procedures and criteria for the allocation of shared resources based on transparent and equitable criteria.**

It is believed that the stocks between the adjacent French and Australian fishing zones that this is not an issue. Because these are fully utilized by the sovereign state, no further allocations have been made.

- **Membership and participation rights that are based, inter alia, on harvesting interests as well as environmental interests (e.g. eco-system and biodiversity interests).**

Environmental interests drive the management of the fishery, both through CCAMLR's ecosystem approach and through the Register of the National Estate and the World Heritage Listing.

- **Mechanisms for the sharing of fisheries management functions and responsibilities as well as the sharing of management costs; and**

Not applicable because of stock segregation.

- **Prevention and elimination of IUU fishing activities**

CCAMLR agreed to a number of measures to mitigate IUU fishing. In particular the mandatory use of automated, satellite-based vessel monitoring systems and the introduction of a certification scheme so that only certified catches of toothfish could be imported to the markets of CCAMLR parties.

MANAGEMENT OF SHARED FISH STOCKS IN THE BARENTS SEA

by

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The Barents Sea is a biologically productive ocean but also quite vulnerable. Seawater temperatures are low, which slows down evaporation processes and may serve to reduce the bacteriological degeneration of pollutants. There are considerable fluctuations in light intensity and variation in the water inflow from the Atlantic imply continual shifts in temperatures and ice extension. Ecosystems are quite simple in that there are few organisms on each link of the chain, so the disruption of one may have serious implications for the rest of the system.

The major commercial groundfisheries target cod, haddock and saithe, while the pelagic fisheries take Norwegian spring-spawning herring, capelin and blue whiting. Harvests are predominantly by the coastal states, Norway and Russia. Among the challenges to effective fisheries management in this region in recent years are (1) the unsettled *maritime boundary* line between these states and (2) their joint inability, until 1999, to reach agreement with all distant-water fishing states on conservation and allocation measures pertaining to the *Loophole*, a pocket of high seas located between their exclusive economic zones. The most heated part of this management dispute coincided in time with the global-level negotiations of the United Nations Fish Stocks Agreement. This paper reviews the role of the bilateral fisheries regime in addressing those jurisdictional challenges, as well as its performance with regard to the tasks that any fisheries management regime must face: (3) generation and imputation of *scientific* knowledge; (4) adoption of management *rules*; and (5) establishment of a system of *compliance* control.

1 CHALLENGES TO THE BARENTS SEA FISHERIES REGIME

Due to the extension of coastal zones from the mid-1970s, a new and largely bilateral fisheries regime evolved as the most appropriate means for management of Barents Sea fish stocks. The new regime replaced a wider regional regime that had its basis in the North-East Atlantic Fisheries Convention. Three agreements between Norway and the Soviet Union form the basis of the Barents Sea fisheries regime. A 1975 Framework Agreement provides for the Norwegian-Russian *Fisheries Commission* as the institutional hub of the regime. The Commission meets annually to make consensual recommendations on total quotas of the three main shared stocks – cod, haddock and capelin, each of which are seen as a single biological unit. Based on fixed initial allocation keys, it allocates quotas to the parties, decides on the shares to be allocated to third parties, and determines operational restrictions. It also coordinates scientific research among institutions in the two countries. The Mutual Access Agreement paves the procedural ground for reciprocal fishing; this Agreement secures parties' access to the 200-mile zone of the other, i.e., access within agreed-upon quotas, beyond 12 miles, and subject to coastal state rules and licensing. For its part, the Grey Zone Agreement sets up a system of enforcement applicable, *inter alia*, to a disputed part of the Barents Sea (see

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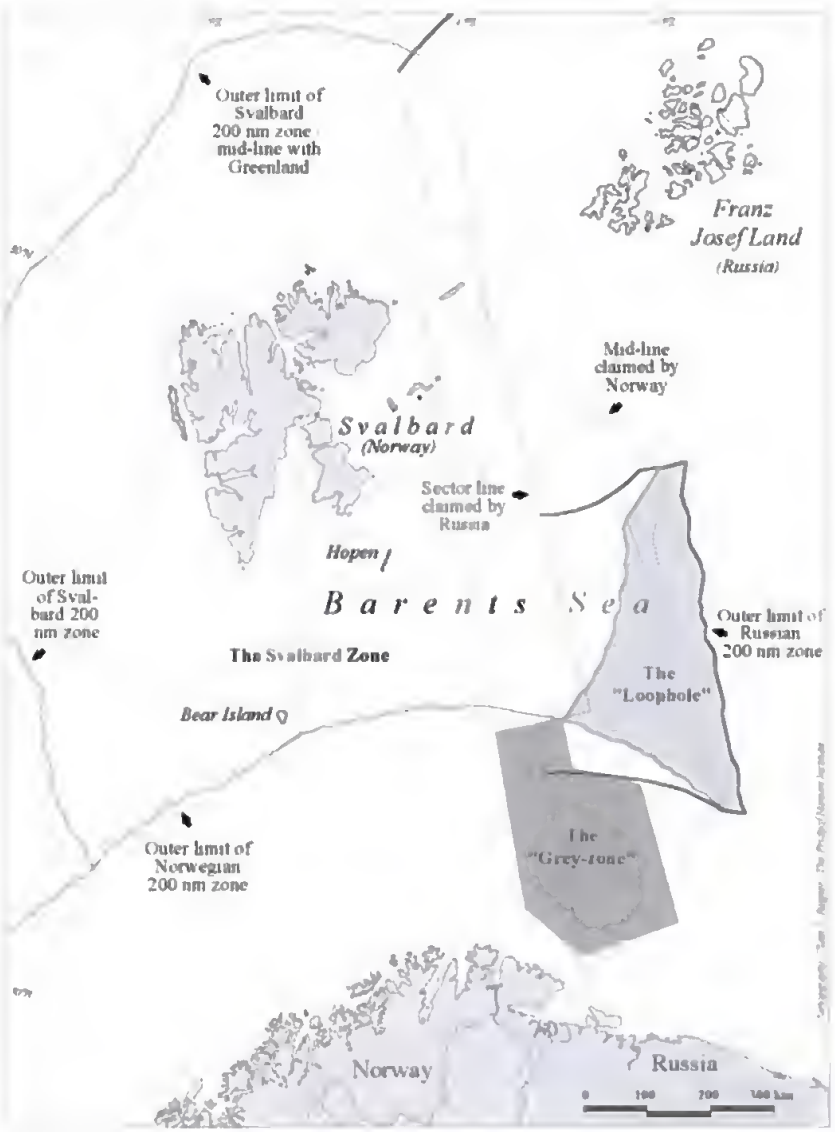
* This paper draws upon Stokke, Olav Schram, Lee G. Anderson and Natalia Mirovitskaya, 'The Barents Sea Fisheries', O. R. Young (ed.), *The Effectiveness of International Environmental Regimes: Causal Connections and Behavioral Mechanisms*, (Cambridge, MA: MIT Press, 1999), 91-154; Stokke, Olav Schram, 'Managing Fisheries in the Barents Sea Loophole: Interplay with the UN Fish Stocks Agreement', *Ocean Development and International Law*, 32 (2001), 241-62; and Stokke, Olav Schram, 'The Loophole of the Barents Sea Fisheries Regime', O. S. Stokke (ed.), *Governing High Seas Fisheries: The Interplay of Global and Regional Regimes*, (Oxford University Press, 2001), 273-301.

map). This Agreement acknowledges parallel jurisdiction in an 'adjacent area' that also covers most of the disputed waters. Russia and Norway have agreed that the enforcement of conservation and management measures in the Grey Zone is to be exercised by the state that has issued the licence to operate there – and both coastal states may issue licenses within agreed quotas.

In addition to these agreements between Russia and Norway, a set of other agreements between these two coastal states and non-coastal user states forms part of the basis for the Barents Sea fisheries regime. In essence, the latter agreements imply that certain non-coastal states obtain access to the Barents Sea fisheries within the overall regulatory framework set up by the coastal states.[1]

While the Barents Sea fisheries complex is simpler than in many other ocean areas, since the harvest is largely taken by two coastal states, a complicating feature is the fact that the area is extremely sensitive in a military sense. This is due to the importance of nuclear submarines deployed in Northern waters for the maintenance of the strategic deterrence, especially during the Cold War period. One consequence of this sensitivity has been helpful to fisheries management, namely that both Norway and the Soviet Union were eager to avoid unnecessary political tension in the area.

[1] Based in reciprocal access agreements, the European Community, the Faroes, Greenland, and Iceland presently have fishing rights in specified national zones in the Barents Sea. In addition, and based on historical fishing, Poland has certain quotas in Norway's EEZ and in the Svalbard zone; and on similar grounds, Canada, Estonia, and Lithuania are granted access to the shrimp fishery in the Svalbard zone; Report to the Storting, Norway, *St.meld.* 11 (1997-98), Sec. 3; a broader discussion is found in *St.meld.* 49 (1994-95).



2 MANAGING FISHERIES IN DISPUTED WATERS

Norway and Russia have still not settled their disagreement over whether the marine *delimitation* should follow a line of equidistance or the sector line, the latter argued by the Russian side. At stake is a disputed area of some 155 000 square kilometres where fishing grounds are rich and the prospects for finding petroleum quite good. Because of the link in international law between the accepted exercise of management authority and the strengthening of jurisdictional claims, this dispute has been hampering resource management in the Barents Sea. Notably, the regime has been structured in order to avoid situations where Norwegian fishermen are subject to Russian inspections in waters claimed by Norway, and vice versa, as such inspections would be seen as jeopardizing the respective claims of these countries to sovereignty over the disputed area.

The key regime component here is the Grey Zone Agreement with its parallel systems of licensing and enforcement in the agreement area, which includes the disputed segment. Before the establishment of that zone, Norway and the Soviet Union were faced with basically three alternative policy options, none of which would have been very helpful with respect to the jurisdictional problem. (1) In order not to provoke the territorial jealousy of the other, both parties might have refrained from intrusive monitoring in the disputed area. In an increasingly regulated fishery, however, such a blind spot would have been quite intolerable, especially as the fish have been very profuse in the disputed area. Moreover, the parties would have had to abstain from the regulation and enforcement of third countries as well, quite detrimental to the thrust of the emerging Law of the Sea Convention. In consequence, coastal state fishermen would have suffered and the health of the fish stocks would have been in jeopardy. (2) Alternatively, one of the parties could have kept a low profile and left regulation and enforcement to the other. There is little doubt that this would have seriously undermined the territorial claims of the restrained party; indeed, the fear that without an agreement the Soviets might try to enforce regulations in the disputed area on their own was very much a concern among key Norwegian decision-makers.[1] (3) Finally, both parties could have behaved as if they were in charge of the disputed area and conducted both regulation and enforcement on all vessels in that area. As the Svalbard experience showed, however, Norwegian inspections of Soviet vessels in an area where Norwegian jurisdiction is not clarified was likely to meet opposition from the Soviet government;[2] and this opposition should logically be even stronger when the Soviets had a claim of their own to the area. The same argument, although softened by the asymmetry in general power relationship, would be valid for Soviet inspections of Norwegian vessels. In both cases, there would be a considerable risk of embarrassing incidents leading to diplomatic activity and possibly conflict escalation.

With the Grey Zone Agreement in place, agreed-upon management measures could be implemented and enforced without such risks; and also without one party having to accept enforcement activity from the other in waters claimed to be her own. Nevertheless, it was a deeply split Norwegian parliament which by only a slight majority passed the Grey Zone Agreement after an unusually bitter debate. The opposition argued that the Agreement was geographically biased by covering an area to the west of the disputed area which was far bigger than that to the east; and also that it might give the Soviets expectations about joint management solutions in the Barents Sea regarding both fish and shelf resources.[3]

If the critics of the Grey Zone Agreement were right when arguing that its geographical location strengthens the Soviet position, the regime would have failed to solve the problem of avoiding negative jurisdictional effects of fisheries management in the area. However, the fact that this temporary agreement has been renewed each year for nearly two decades without any debate suggests that these effects, if there, are no longer seen as too significant. It seems safe to conclude, therefore, that the regime has successfully decoupled necessary regulation and compliance control activities from the contested territorial issue.

3 DEALING WITH NEWCOMERS: THE LOOPHOLE CASE OF A STRADDLING STOCK

Because of changes in temperature and salinity, the availability of cod in the Barents Sea Loophole, which spans some 62 400 square kilometres, increased markedly around 1990. Cod thus became a straddling as well as a shared stock, and despite the short season due to ice conditions, this new fishing opportunity soon attracted the attention of distant water vessel operators. In 1991 the fishery began cautiously, with vessels from the European Community, Greenland and the Faroes; but two years later it accelerated when Iceland turned its attention vigorously to this fishery. A drop in the total cod quota in domestic waters to a historic low – combined with a rapid growth in the harvesting capacity of Iceland's fleet – prompted the Icelandic interest.

By 1995, as many as eighty Icelandic trawlers had operated in the Loophole.[4] Whereas the third party catch was a moderate 12,000 metric tonnes in 1993, this increased to roughly 50,000 tonnes the following year. In

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[1] Minister of Maritime Law, Jens Evensen, in Debates in the Storting (St.f.) 9 March 1978.

[2] See R. R. Churchill and G. Ulfstein, *Marine Management in Disputed Areas: The Case of the Barents Sea* London: Routledge, 1992.

[3] Recommendation S. of the Standing Commitee on Foreign Affairs and the Constitution (Innst. S.) 190, 1977-78; and Debates in the Storting (St.f.), 9 March 1978.

[4] *Daily News of Iceland* (online at www.icenews.is/), 3 November (1995).

that peak year of 1994, high seas catches comprised around seven percent of the total cod harvest in the Barents Sea ecosystem. For several years afterward the fishing effort remained high, but catches declined as the migration pattern of the cod again shifted southwards.

3.1 Coastal state strategies

Faced by newcomers in the Barents Sea, Norway and Russia argued fervently that both *zonal attachment* and *historical fishing* suggested that the cod stock was binational. Noting also that the stock was fully utilized, the coastal states rejected the legitimacy of the unregulated activity in the Loophole. Many of the foreign fishing vessels that operated in the area were flying flags-of-convenience, and this rendered the traditional, diplomatic channel less effective as a means of dealing with such a problem.

The Barents Sea fisheries regime did not serve as an effective tool for the coastal states in their efforts to cope with the Loophole challenge. The gradual phasing-out of non-coastal state fishing from the region in the 1970s had been validated by the acceptance of EEZs in international customary law, but no such support from broader normative developments was forthcoming in the early 1990s. On the contrary, the Icelandic appearance in the Loophole coincided with the first session of the UN Fish Stocks Conference, which implied that the rules governing the interaction between coastal states and distant water fishing nations on the high seas were in a state of flux.

The measures available to Norway and Russia were therefore largely diplomatic and economic. Unlike the Sea of Okhotsk case, no naval exercises have occurred in the most relevant fishing area that could be perceived as partly motivated by fisheries concerns.[1] Although the coastal states soon agreed to step up diplomatic pressure on flag states and to enhance coastal state presence in the area in terms of control vessels, there was a lack of willingness to use those vessels for anything more drastic than observing the unregulated harvesting activity in the region. Instead, what may be coined the 'quota card' became the most powerful means to dissuade newcomers from engaging in unregulated harvesting. Coordinated allocation of parts of the total quota to third parties was provided for in the annual bilateral protocols drawn up by the coastal states. After bilateral negotiations with Norway in 1991-92, Greenland and the European Community decided to limit activities in the Loophole and keep total harvests in the Barents Sea within the overall quotas allotted under reciprocal access agreements. The Faroes agreed in 1996 to prohibit landings of fish that had been taken without quotas in international waters.

The coastal state diplomatic strategy versus Iceland, the remaining challenger, proved much less effective. When the Icelanders first appeared in the area, Norway and Russia argued that Iceland had no historic record of harvesting in the region and refused to negotiate Icelandic demands for a Barents Sea cod quota. As a result, although their vessels fished on the same stock, coastal and non-coastal user states remained unable to achieve compatible measures through coordination of their management policies. Formal negotiations began in 1995, partly because the Icelanders, refusing to yield to political pressure, had rapidly acquired some 75 percent of the unregulated harvests in the Loophole, and partly because the coastal states were reluctant to stretch international law regarding unilateral enforcement measures beyond 200 miles, an issue that at the time was under negotiation in the UN. The coastal states sought to establish an arrangement that would give Iceland a share of a separate Loophole quota; the size of the total Loophole quota would correspond with the zonal attachment of the cod stock to the high seas area, estimated at two percent.[2] After years of negotiations, however, no agreement had been reached, despite various economic sanctions launched by the coastal states to render unregulated harvesting more costly. In Norway, domestic legislation was introduced in 1994 prohibiting the landing of high seas catches taken without a quota; in practice, even port calls were rejected.

Another significant coastal state measure to deter unregulated high seas activities was the practice of *blacklisting* Loophole vessels from subsequent access to the Norwegian EEZ, even if the vessel had changed

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[1] On the Sea of Okhotsk situation, see A. G. Oude Elferink, "The Sea of Okhotsk Peanut Hole: *De facto* extension of coastal state control", in Stokke, *Governing High Seas Fisheries*.

[2] *St.prp.* 74 (1998-99), Sec. 4.

ownership in the meantime.[1] In 1998, such blacklisting was extended to port calls and the result was to reduce the second-hand value of vessels with a history of contravention of rules created by the Norwegian-Russian Fisheries Commission, especially on the European Community market.[2] Like blacklisting of vessels, industry-level sanctions cannot be challenged on the basis of international trade rules, and during the peak years of the Loophole fishery, a series of private *boycott* actions were introduced that aimed at strangling Norwegian supplies of provisions, fuels, and services to Loophole vessels, as well as punishing domestic companies that failed to adhere to such boycotts. The Russian Fisheries Committee exerted similar pressure to bear even in Icelandic ports by encouraging the Murmansk-based industry to discontinue landings of cod from Russian vessels at ports in Iceland. Because of the cod crisis in Icelandic waters, supply contracts with Russian companies were important to the processing industry of that country during the 1990s.

The public and private sanctions did not deter unregulated harvesting activities, mainly for two reasons: The fleets operating in the Loophole were able to operate independently of the Russian and Norwegian fishing industries, and the Icelanders were determined to establish a sizable fishery in the Loophole. In the long run, however, reliance on Icelandic ports, some four day-trips away, would add considerably to the over-all costs of fishing in the Barents Sea. This is especially true for new, efficient trawlers, the profitability of which tends to be highly sensitive to reductions in the number of annual fishing-days.

3.2 The Loophole Agreement

In 1999, a regional accord was finally reached. The terms of the Agreement are similar to those previously drawn up bilaterally between Norway and Greenland and the Faroes. In exchange for cod quotas in the EEZs of the Barents Sea, Iceland must refrain from harvesting cod or seeking new fishing rights for the cod stock beyond the coastal zones; Iceland must also open its national waters to vessels from the other two countries. Other provisions oblige the parties to discourage their nationals from operating vessels under flags of convenience in the Barents Sea, to prohibit landing of catches that are taken without a quota, and, subject to other obligations under international law, to deny port access to vessels that engage in these activities. As a result of the Agreement, Icelandic vessels were removed from the 'black list' of vessels that are banned from the Norwegian EEZ. The steep decline of the Loophole fisheries in the years preceding the signing of the Agreement had served to reduce the distance between coastal state quota offers and Icelandic demands, and the Agreement provides for a stable Icelandic share of a little less than two percent of the TAC.

3.3 Regional-global Interplay: The U.N. Fish Stocks Conference

Because there was a partial overlap in time between the Loophole dispute and the negotiation of the U.N. Fish Stocks Agreement, it is of interest to examine how the regional-level process influenced the global negotiations. There are generally at least two ways in which regional management disputes can influence the course and outcome of global negotiations. First, by a process that may be termed diffusive interplay, the substantive or operational solutions to difficult problems that regional negotiations may reach can be adapted for use at the global level. Second, through political interplay, regional disputes may influence the relative bargaining power of competing blocs or encourage or facilitate various types of leadership activities at global negotiations.

In the years it took to negotiate the U.N. Fish Stocks Agreement, regional efforts to manage the Loophole fishery moved from disappointment to disillusionment. Several rounds of negotiations, bilateral and trilateral, were held without the emergence of any substantial resolution. The only allocative "solution" discernible in the Loophole case was the usage by the coastal states of the quota card to dissuade long-distance fishing operations. The quota trade-off solution was ineffectiveness with respect to Iceland and not consistent with the emphasis in the Fish Stocks Agreement of a multilateral approach to regional management. *Diffusion*, therefore, formed a negligible part of the interplay between the evolving Loophole regime and the U.N. Fish Stocks Agreement.

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[1] *St.prp.* 73 (1998-99), Sec. 2.2; legislation providing for such blacklisting was introduced in 1994 but not used in practice until 'around 1997'; *ibid.*

[2] The European Community is granted considerable quotas of several species in the Norwegian EEZ.

With regard to *bargaining power*, the three main antagonists in the Loophole dispute all belonged to the coastal state bloc during the negotiation of the Fish Stocks Agreement; but each state also had a tradition of distant water fishing operations.[1] True to tradition, Iceland was one of the original members of the so-called core group, the group of coastal states that played a very active role in the process that led up to the Fish Stocks Conference. Throughout the negotiations, the core group remained a salient forum for joint action, including the drafting of proposals on controversial issues. When a large fleet of Icelandic vessels became engaged in controversial high seas activities in the Barents Sea, however, Iceland's participation in the core group became more problematic.

Because of its distant water fishing interest, and also with a view to upcoming membership negotiations with the European Union, Norway responded with caution to the idea of convening a straddling stocks conference under the auspices of the United Nations and did not support the so-called "Santiago Document" that emerged from the Fourth Preparatory Committee Meeting to the UN Conference on Environment and Development in 1991.[2] The Norwegian fisheries bureaucracy had entered the process at a fairly late stage and it was only in the months prior to the first substantial session of the Fish Stocks Conference in July 1993 that a broad assessment was made of the various interests involved. Influenced partly by the Loophole situation, but also by the expected resumption of high seas fisheries for Norwegian spring-spawning herring by non-coastal states in the North-East Atlantic, Norway placed itself firmly on the coastal state side of the straddling stocks issue.

Russia, for its part, has traditionally loomed large in the global distant water fishing league. However, a decade of phase-outs from foreign coastal zones had prompted a partial return to domestic waters that was accelerated by the economic decline of the 1990s and the rapid privatization of the fishing industry, both of which implied greater attention to the fleet's operational costs. Whereas an estimated half of the Russian catch was taken in waters beyond its jurisdiction in 1980, the share had fallen to 22 percent in 1994.[3] However, the Barents Sea situation was hardly decisive for Russia's position as being "like-minded" with the coastal state core group on key issues at the Fish Stocks Conference. The Russian posture preceded the escalation of the Loophole issue in 1993 and was largely shaped by the already well-established high seas dispute in the Far East, a region where today no more than two percent of the harvest is taken outside the EEZ.[4]

Whereas several forms of *leadership* were exercised by the parties to the Loophole dispute during the Fish Stocks Conference, on close inspection none of these leadership roles appears to have been triggered by the Barents Sea situation.[5] Historically, Iceland's dependence on fisheries and overall reliance on proximate fishing grounds that traditionally had also been exploited by others largely explains the structural leadership it was able to provide in the early 1970s to expanding fishing zone states. Structural leadership implies the ability to bring material capabilities to bear on the negotiation of particular issues. Iceland's establishment and stubborn enforcement of first a 50-mile and then a 200-mile exclusive fishery zone placed Iceland among the coastal state front-runners in the Law of the Sea context.[6] In the pre-negotiation stage of the UN Fish Stocks Conference, Iceland again was actively promoted coastal state interests. The emergence of the

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[1] For a lucid exposition of key issues and bargaing blocs during the Fish Stocks Conference, see D. A. Balton, "Strengthening the Law of the Sea: The New Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks", *Ocean Development and International Law*, Vol. 27 (1996), 125.

[2] The "Santiago Document", drawn up at the initiative of a group of Latin American states prior to the Third Preparatory Committee Meeting in August 1991, argued strongly in favour of the coastal states' having a greater say in the management of high seas fisheries.

[3] The estimate is made in *Seafood*, Report of the American Embassy, Moscow, as cited in Oude Elferink, *supra* note 14. More recently, Russian attention to distant water fisheries is reportedly again on the rise.

[4] V. Monakhov, "The Fishery Industry in the Russian Far East", *Eastfish Fishery Industry Profile*, 19 (Copenhagen: Eastfish, Food and Agriculture Organization, 1998), 16.

[5] For an interesting discussion of three types of leadership in multilateral negotiations, see O. R. Young, "Political Leadership and Regime Formation: On the Development of Institutions in International Society", *International Organization*, Vol. 45 (1992), 281.

[6] For an overview, see J. T. Thór, *British Trawlers and Iceland 1919-1976* (Gothenburg: Department of Economic History of the University of Göteborg, 1995).

Loophole controversy, however, blended the traditional interests with a concern for the rights of newcomers on the high seas and a corresponding reluctance to extend coastal state enforcement rights in such waters.

The Barents Sea situation was not conducive to motivating Norway and Russia to take coercive measures and thus provide the type of structural leadership that had been provided by Iceland in the 1970s and by Canada in the high seas detention of the Spanish trawler *Estai*.[1] As unregulated fishing in the Loophole continued to grow, fishery organizations in Norway and Russia called for emergency measures and demanded a more activist approach to unregulated harvesting, including intrusive enforcement measures towards foreign vessels. In 1997, a centre-liberal coalition government was formed in Norway on a political platform that included "consideration of...a Norwegian-Russian initiative to extend the Norwegian and Russian exclusive economic zones to 250 nautical miles".[2] Once in position, however, the new Prime Minister assured that no unilateral measure was contemplated and that any initiative would occur within the framework of international law.[3] The tactical wisdom of any type of unilateral measures in this case would indeed have been highly questionable. Such measures, were they to contribute to the making of international law, would require consent or acquiescence on the part of those subject to them as well as third parties. Dealing with a much more threatened fish stock, a leading scholar, W.T Burke, has argued that even for a stock that occurs mainly within the EEZs, customary international law does not authorize unilateral measures by coastal states unless *bona fide* efforts to reach an agreement with the high seas fishery nations have failed and even then only if no scientific doubt exists that the unregulated fishery will jeopardize the health of the stock.[4] Partly for this reason the United States and Russia abstained from unilateral or bilateral regulation of high seas activities in the Bering Sea Doughnut Hole, even when the level of overfishing was known to be destructive to the pollock.[5]

Compared to the Bering Sea situation, or Canada's high seas problem in the Northwest Atlantic, the Loophole case was an unlikely candidate for yielding the consent necessary before unilateral action may contribute to changing the existing international law. Even in the record year of 1994, the unregulated cod catch was no more than one third of the increase in the total quotas from the preceding year. While certainly a nuisance, this level of unregulated fishing could hardly be said to create a state of emergency. This, combined with the fact that Iceland repeatedly declared its willingness to negotiate with the coastal states, implied that unilateralism on the part of Norway or Russia would have been very hard to justify.

Norway had a very high profile during the Third Law of the Sea Conference, not least because its delegation head had the role of leader of the informal "group of legal experts" which hammered out compromises on some of the more controversial issues.[6] Also at the Fish Stocks Conference, Norway sought an influential position by assuming a high level of activity and seeking out powerful allies. After clarification of its position during the preliminary stages, Norway first joined forces with the group referred to as "like-minded" with the coastal state core group before being admitted as a member of the core group in 1994. Among the issues given particular attention by the Norwegian delegation was that of the improved means of non-flag state enforcement. Norway eagerly supported proposals for port state measures, including prohibition of landings from vessels engaged in unregulated fishing operations on the high seas.[7] During the fourth session, moreover, Norway came forward with a formula for the division of duties and responsibilities between inspecting state and flag state; a formula that advanced the negotiations on one of the most controversial

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[1] On the 1995 *Estai* incident, see C. C. Joyner, "On the Borderline? Canadian Activism in the Grand Banks", in Stokke, *Governing High Seas Fisheries*.

[2] *Sentrumsalternativet - Vilje til ansvar*; <www.aftenposten.no/spesial/valg97/sentrum.htm>, Sec. 2.2.2.8; author's translation.

[3] Kjell Magne Bondevik in *Aftenposten*, 17 October 1997.

[4] W. T. Burke, "Fishing in the Bering Sea Donut: Straddling Stocks and the New International Law of Fisheries", *Ecology Law Quarterly*, Vol. 16 (1989), 285.

[5] D. A. Ballon, "The Bering Sea Doughnut Hole Convention: Regional Solution, Global Implications", in Stokke, *Governing High Seas Fisheries*.

[6] This group, widely known as the Evensen Group, was in operation from the very first (organizational) session in New York in December 1973, and the group played a significant role *inter alia*, by drafting negotiating texts.

[7] The relevant provision in the Fish Stocks Agreement is Article 23.

aspects of the Fish Stocks Agreement.[1] The Norwegian proposal also contained the idea that agreed upon enforcement procedures would be applicable even to parties of the Agreement that were not members of the relevant regional fisheries management body, thus laying down global minimum standards on enforcement applicable in all regions.[2]

In summary, compared to some of the other regional straddling stocks issues, such as that in the Northwest Atlantic and, in a more restricted sense, that of the Sea of Okhotsk, the high seas problem in the Barents Sea had scant impact on the Fish Stocks Conference.[3] The relative strength of the major bargaining blocs was largely unaffected. Nor did the Loophole issue provide sufficient urgency to prompt structural leadership in the form of unilateral measures on the outer edges of international law. And finally, most of the rather moderate entrepreneurial and ideational leadership provided by the parties to the Barents Sea dispute was only loosely related to the specifics of the Loophole case.

4 MEETING THE TASKS OF FISHERIES MANAGEMENT

Although in practice they often interact, it is useful for analytical purposes to distinguish three aspects of the fisheries management problem: generation of adequate *knowledge* about the health of the ecosystem and the impact of harvesting of various stocks; ensuring that available scientific knowledge is applied in the establishment of adequate *regulations*; and *compliance* control, including monitoring in order to assess adherence to the regulations as well as imposition of sanctions on violators. In the following, the performance of the Barents Sea fisheries regime on those three dimensions is examined more closely.

4.1 Scientific basis

The science problem of fisheries management is to generate high-quality, consensual assessment of stock dynamics and translate such knowledge to practical regulatory advice. The emergence of the bilateral regime did not lead to dramatic shifts in how fisheries investigations were planned or conducted and how the results were imputed into the process. Rather, bilateralization appears to have supported and stimulated activities that were already underway in the Barents Sea. Even prior to the regime, scientists in each country were called upon to make recommendations on quotas and operational restrictions. Initiated already in the 1950s, non-governmental collaboration between Norwegian and Soviet research institutions grew steadily in scope and intensity. Today, this scientific cooperation, which is nested within the broader cooperation under the International Council for the Exploration of the Sea (ICES), ensures that the Barents Sea stocks are comparatively well covered with respect to scientific investigation. An elaborate reporting system has traditionally formed the backbone of the data input, but as the incentive to under- report catches has gradually grown, fisheries-independent analysis has gained in importance. Cooperative Norwegian-Russian survey programmes are elaborated and implemented each year, ensuring inter-calibration of measurement and data processing for the entire ecosystem.[4] Partly because these scientific organizations have been strong in different areas, this cooperation has probably enhanced their capacity to produce policy-relevant knowledge. The significance of the regime for this growing collaboration is partly to provide a framework that facilitates regularity of interaction between scientists and partly to place scientific investigation close to the centre of the decision-making process.

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[1] On Norway's role, see M. Hayashi, "Enforcement by Non-Flag States on the High Seas Under the 1995 Agreement on Straddling and Highly Migratory Fish Stocks", *Georgetown International Environmental Law Review*, Vol. 9 (1996), 1, at 16, citing an Informal Paper of the Chairman of the Conference. "Issue Raised by Norway" (25 August, 1994). The relevant provision in the Fish Stocks Agreement is Article 21.

[2] See Fish Stocks Agreement, Article 21, paras. 1-3 and Hayashi, *supra* note 63, at 16.

[3] On the significance of the situation off Canada for the convening of the Conference, as well as some of the key issues discussed therein, including new measures for enforcement, see D. H. Anderson, "The Straddling Stocks Agreement of 1995 – An Initial Assessment", *International and Comparative Law Quarterly*, Vol. 45 (1996), 463.

[4] Since 1997, however, despite efforts of Russian fisheries authorities, Norwegian research vessels have either been denied access to the Russian zone or been severely limited in their operations, a policy widely perceived as originating in naval quarters.

Regarding the Loophole, coastguard vessels from the two coastal states, and at times even from Iceland, maintained a presence in the area throughout the years of large-scale fishing, allowing rough estimates of the amounts taken by foreign vessels. In addition, Iceland published data concerning domestic landings from the Loophole. Icelandic catch statistics have also included the harvest from vessels under Icelandic ownership but which were flying flags-of-convenience, presumably an attempt to accumulate some track level of fishing in the area.

Since 1998, the scientific component of the Barents Sea management regime has established precautionary reference points for the shared stocks, including cod, as called for by the 1995 United Nations Fish Stocks Agreement.[1] Such reference points, corresponding to the state of the stock and of the fishery, are intended to guide fisheries management decisions.

4.2 Conservation and management measures

The bilateral Barents Sea regime has facilitated generation of adequate fisheries regulations in two notable ways. First, the regime provides a clear framework within which the two parties can license one another's vessels for *operating in their respective EEZs*. This is relevant both for exclusive and shared stocks. Each year Soviet, and later Russian, vessels have been allowed to take roughly half of its groundfish quotas in the Norwegian EEZ. Although this arrangement means more competition for the Norwegians, especially the coastal fishermen with limited operational range, it is widely recognized as rational because the fish are larger in this part of the ecosystem and thus, it takes fewer individuals to fill the quota. Indeed, this was one of the major goals of the negotiators. When presenting the Mutual Access Agreement to the Norwegian parliament, the government noted regarding Arctic cod that 'optimal exploitation of the stocks requires that a rational division is found between catches of juvenile fish in the northern and eastern Barents Sea and those of fertile and spawning fish in the future Norwegian economic zone'.[2]

Although this was never a part of the official rationale for that specific agreement, the Norwegian Foreign Minister later stated in the Barents Sea context that as a result of increasing activity in the northern areas '...we must be both mentally and practically prepared for new episodes to occur...' and that it was '...important to have developed procedures and methods designed to prevent new episodes from leading to conflicts'.[3] Thus, by specifying very clearly in the Mutual Access agreement conditions and procedures to be followed by both parties, the regime removed a set of potential risks which might otherwise have induced Norway to prevent Soviet vessels from taking parts of their quota in Norwegian waters.

The reciprocal access rules are important also because they facilitate a regular and mutually beneficial *quota exchange*, in which Norway has received primarily cod, shrimp, and scallop in exchange for larger quantities of redfish, blue whiting, and sometimes herring.[4] Given the differences between the two states in terms of fleet structure and reliance on groundfish, such trading of fishing rights has cushioned the transition to the new coastal state regime and enabled a better utilization of both existing capital and the fisheries resources.[5] With the regime in place, this became part of a regulated and reciprocal practice, and the amount of cod the Soviets were allowed to take in Norwegian waters could be tailored to the needs of coastal fishermen, hence reducing potential anxiety in the northern fisheries communities.

In an ideal world, conservation and allocation of fish resources would be addressed sequentially. On the basis of the best available knowledge, parties would decide on the appropriate level and mode of fisheries pressure before they addressed the question of how catches should be allocated among various users. The

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[1] *ICES Cooperative Research Report*, 229, Part 1 (Copenhagen: International Council for the Exploration of the Sea, 1999), 17-39 and 79-84.

[2] Proposition to the Storting (St.t.prp.) 74, 1976-77, p.1; our translation.

[3] Foreign Minister, Knut Frydenlund, Foreign Policy Statement in the Storting (St.f), 15 November 1978; our translation.

[4] For an assessment of the balance of this exchange, see Olav Schram Stokke and Alf Håkon Hoel, 'Splitting the Gains: Political Economy of the Barents Sea Fisheries', *Cooperation and Conflict*, 26 (1991), 49-65.

[5] Unlike the trawler-based Russian industry, as much as two thirds of the Norwegian cod harvest in the Barents Sea is taken by small and medium-sized vessels with few alternative targets.

reality, however, is often that problems of allocation permeate the regulatory process and encourage states to compromise on conservation needs. The second way in which the regime has facilitated regulation is to soften this particular barrier to effective management. Even prior to the signing of the Framework Agreement in 1975, the parties had reached an understanding on an equal sharing of Arctic cod and haddock for 1976; and these *fixed keys* were confirmed two years later.[1] Unlike more mature sharing arrangements, such as those between Norway and the European Union, based on stable or adjustable zonal attachment, the Barents Sea solution reflected partly historical fishing but predominantly a political need among the participants to agree on the issue. Zonal attachment was problematic to assess since the EEZ delimitation was and continues to be a matter of dispute; and besides, there was inadequate knowledge about the biological distribution of the stock. Only in 1979 was the capelin division set, and the 60/40 solution in favour of Norway was a result of both historical catches and additional scientific input on stock abundance and migration.[2] The fact that the initial division of the shared stocks is not subject to negotiation at Commission meetings means that the quota negotiations are not beset with difficult questions of distribution: the fixed keys provide a safety net or a fallback division if these negotiations should fail. As the parties can be confident about the share they will acquire, this year and in the future, they can concentrate on issues of over-time conservation.

4.3 Compliance control

Overfishing of allotted fishing quotas and disregard of technical conservation measures are pervasive phenomena everywhere, and the Barents Sea is no exception. The issue of encouraging adherence to regulatory measures agreed to within fisheries management regimes can be approached from two angles – one discursive and one coercive. A high degree of involvement of target groups in decision making, with a view to strengthening their responsibility for regulative outcomes, is among the more common *discursive* compliance mechanisms in fisheries management. Another mechanism is to assign a rather prominent role to scientific advice in the regulatory process. Such investigations often involve, or at least are open to, scientists from all member states. We have seen that both stakeholder involvement and mobilization of scientific authority are prominent features of the Barents Sea regime.

For their part, coercive compliance activities comprise surveillance, detention, and legal prosecution. There is little doubt that domestic enforcement institutions would have existed even in the absence of the international regime: they are set up primarily to meet domestic needs. As shown above, however, an important outcome facilitated by the regime is that the *geographic coverage* of inspections includes the disputed area of the Barents Sea, since the specifics of the Grey Zone Agreement serve to decouple such practices from the competing territorial claims. While for each party, the regime solves only half of the problem of conducting management in disputed waters, as it allows enforcement only for vessels licensed by itself and gives no access to the enforcement behaviour of the other party, it has been instrumental in meeting part of the enforcement requirements in the disputed area.

The Barents Sea fisheries regime has also served to *draw political attention* toward inadequate implementation and enforcement practices, thus adding embarrassment. In general, by ensuring a regular and publicly available set of standards, both scientific recommendations and administrative rules, by which behaviour can be evaluated, the regime serves to increase the general exposure of fisheries management to criticism and political pressure. The regime's bilateral character has rendered it harder for the coastal states to ascribe inadequate management performance to general collective action problems inherent in large-number management systems: while they can still blame the other member, the regime has boosted the accountability of the fisheries authorities in the two states. The embarrassment pathway was clearly relevant in a case involving an increasingly deficient Russian compliance control system following the liberalization of foreign trade. The Soviet compliance system had been based on comparison of catch reports by vessels with delivery reports by processors. From the early 1990s, most of the Russian harvest was delivered in Western ports, especially Norway, which created an enforcement deficit in waters where Russian-licenced vessels could not be inspected by the Norwegian Coast Guard. According to ICES, as much as a quarter of the harvest in 1992 was taken in excess of allocated quotas and went unreported, the lion's share taken by Russian vessels. The

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[1] Sigmund Engesæter, 'Scientific Input to International Fishery Agreements', *International Challenges*, 13 (1993).

[2] Engesæter, 'Scientific Input'.

Norwegian harvesting sector and fisheries press were highly critical of the way Russian quota commitments were implemented, and Norway raised the issue with reference to the third country quota agreed to in the annual negotiations and the need for adequate control measures.[1] Norwegian concern grew further when Faroese vessels were allowed to buy parts of the already substantially overfished Russian quotas and operate, virtually uncontrolled, in large parts of the Barents Sea. While the initial Russia response was that Russian authorities had no evidence of illegal operations, a few weeks later the Faroese were thrown out of the Russian zone despite the fact that in the meantime they had bought additional quotas from Russian companies. Moreover, a whole menu of Norwegian proposals to enhance the transparency of Russian operations in its own waters were accepted by Moscow, including routinized exchange of information on landings and inspection reports, direct lines of communication between inspection vessels of the two states, and collaboration on the development of a positional tracking system for the entire Barents Sea.

5 CONCLUSIONS

Has the Barents Sea fisheries regime been effective in helping its members to meet the internal and external challenges to effective management in the region? (1) The problem of getting a fisheries management system up and running in the *disputed parts* of the Barents Sea without jeopardizing competing claims to sovereignty has been largely solved. The regime itself, particularly the Grey Zone Agreement, has played an important part by blurring the relationship between necessary regulatory and compliance control activities in the disputed area and the substantiation of sovereignty claims. (2) In contrast, the bilateral regime has had only moderate impact on efforts to cope with the *external challenge* to coastal state authority in the high-seas Loophole area. The regime helped to harmonize coastal state measures on the issue, the most powerful of which was regulation of access to national waters and ports. Except with regard to the disputed area, however, both the allocation of quotas to those who would follow the coastal state rules and the blacklisting of vessels that engaged in unregulated Loophole harvesting would have been perfectly feasible even without the Norwegian-Russian Fisheries Commission. As to interplay between regional and global high-seas fisheries law, the Loophole challenge galvanized Norway's and Russia's allegiance with the coastal state bloc in the negotiation of the United Nations Fish Stocks Agreement, whereas Iceland's engagement in this fishery motivated it to move from active participation in the coastal state core group to a more mixed position.

Three other sets of challenges revolve around proper use of the resource over time. As to (3) *scientific* investigations, some level of cooperation would have been realized anyway through ICES, but there is little doubt that the regime has enhanced the generation of scientific knowledge about stock dynamics in the Barents Sea as well as the imputation of such knowledge into the management process. (4) As to conversion of such knowledge to adequate *regulation* of harvesting, the bilateral regime has promoted more rational employment of fishing effort by reducing fears that reciprocal fishing may lead to political incidents or undermine coastal state authority. Arrangements for mutual access in national zones has also facilitated an advantageous quota exchange among the coastal states. The bilateral regime has moreover developed ways to depoliticize conflictual allocative issues, as shown especially by the fixed keys on the initial quota division of shared stocks. Concerning (5) *compliance control*, the regime has been partly successful. It has improved, as noted, the geographic coverage of such activities by ensuring that licencing and inspection in the disputed part of the Barents Sea can occur in a way which touches only lightly on the sovereignty issue. Moreover, the regularity of Commission meetings, involving largely the same key people from one year to another, has made it more embarrassing for compliance control laggards, such as Russia in the early 1990s, to continue lenient enforcement of commitments taken on under the regime.

[1] Director General and Norwegian representative in the Joint Commission, Gunnar Kjønøy in the Norwegian Ministry of Fisheries to *Fiskaren*, 12 August 1992.

THE MANAGEMENT OF REDFISH (*SEBASTES MENTELLA*) IN THE NORTH ATLANTIC OCEAN – A STOCK IN MOVEMENT

by

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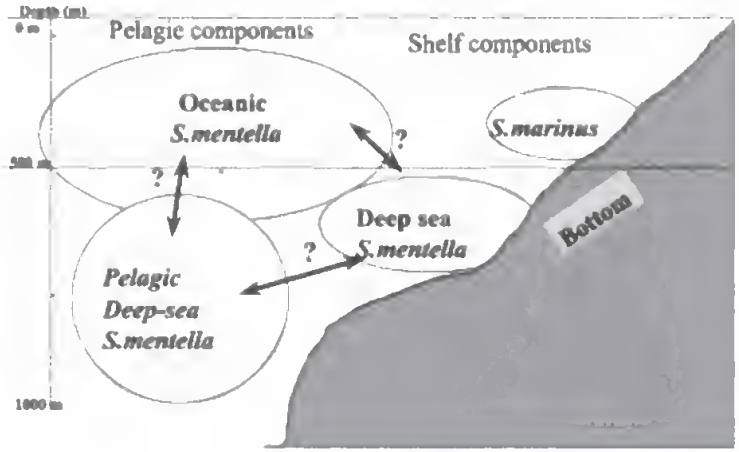
(With particular thanks to Hans-Joachim Rätz at the Institute for Sea Fisheries in Hamburg and to ICES)

Biology of pelagic redfish in the North Atlantic Ocean

There appear to be two distinct redfish components in the area of the Irminger Sea, which is in the North Atlantic west of Iceland. The first are the shelf components, which consist of *Sebastes marinus*, occurring at depths generally above 500 metres and deep sea *Sebastes mentella* normally found below this level. The second components are the "oceanic" and "pelagic deep-sea" forms found in the Irminger Sea and they are sometimes referred to as pelagic redfish in order to differentiate them from the redfish associated with the slope and shelf areas. Indications are that these may consist of oceanic *Sebastes mentella*, found at both depths though mostly in the upper one, and pelagic deep-sea *Sebastes mentella* found mainly at the lower depth. Nevertheless, there are substantial overlaps between the various stock components of *Sebastes mentella* and the relationships between them are both complex and not clearly differentiated. Genetic studies which have been published, on not able to conclude on whether the three forms of *Sebastes mentella* are genetically distinct.

Figure 1 – Schematically possible relationship between different stocks of redfish in the Irminger Sea and adjacent waters



Trawlers using demersal and pelagic trawl have caught most of the redfish caught in Division Va. The major part of the catches are taken by Iceland, although there are catches in this area by the United Kingdom, Germany and the Faroe Islands.

In Division Vb, the redfish are caught mainly with demersal trawl, with the Faroese catches comprising more than 90% of catches. Occasionally, the fleets of France or Germany target the fisheries. The remainder of the catches taken in the division are by-catch in other demersal fisheries.

In Sub-area VI, redfish are taken by several countries and are considered to be mainly by-catch in demersal fisheries.

In Sub-area XII, the catches taken are mainly of pelagic *Sebastes mentella* and are taken by pelagic trawls with fisheries conducted by a number of countries, including the Russian Federation, Germany, Faroe Islands, Iceland and Norway.

Regarding Sub-area XIV, both *Sebastes marinus* and *Sebastes mentella* stocks are exploited. Since 1990, the main fleets conducting the fisheries have been from the Russian Federation, Norway, Iceland and Germany although in more recent years, vessels from several other countries have joined these fisheries conducted in the main outside the Greenland and Icelandic EEZs.

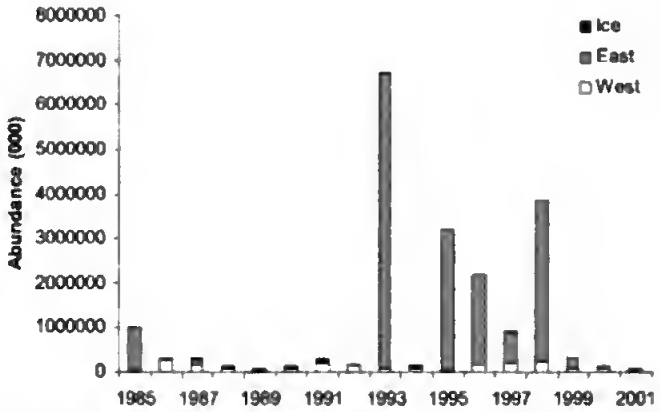


Figure 2 – *Sebastes mentella* (< 17cm). Survey abundance indices for East and West Greenland and Iceland derived from the German and Icelandic groundfish surveys, 1985 to 2001

Throughout the 1980s and the 1990s until 1997, surveys in both the Convention Area of the North East Atlantic Fisheries Commission (NEAFC), (in the Exclusive Economic Zones of Greenland and Iceland, as well as on the high seas) and nearby showed decreases in abundance towards NAFO Division 1F to the south and to the west. Some scientists had felt that the area surveyed before 1997 had covered the majority of the stock range.

3A – June / July 1992 – 1997

3B – June / July 1999 – 2001

Figure 3 – Survey information on the **main** distribution of pelagic redfish in June/July 1992-1997 and 1999-2001 above 500 m depth.

In 1999, the survey was expanded and more fish were found to the south and west. A high abundance was observed at the western border of the survey. The stock may have been moving in a westward direction into the adjacent waters managed by NEAFC's sister organisation, the Northwest Atlantic Fisheries Organisation (NAFO), and was extending towards the Canadian EEZ. For the first time in the surveys, redfish below 28 to 30cm were found. Based on charting of extrusion and 0-group abundance, it was clear that the extrusion and larval areas were mainly off East Greenland. Furthermore, the feeding areas were stretching into the NAFO waters of Division 1F.

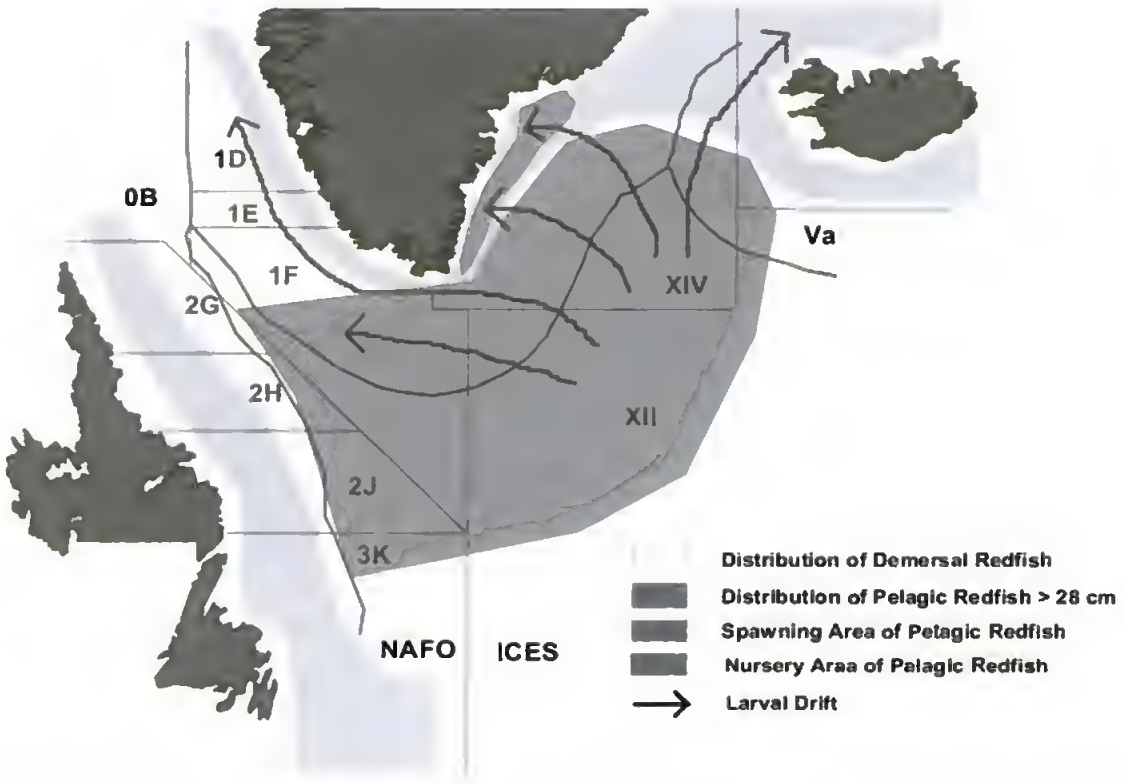


Figure 4 – Distribution area of demersal and pelagic deep-sea redfish (*Sebastes mentella*), nursery grounds and larval drift

Reasons for the migration of the stock remained unknown and it was unelear whether the movement was permanent or not. One theory links the migration to a general inerease in the sea temperature. The oceurrenee in NAFO waters was entirely seasonal (from June until November) with the redfish returning to NEAFC waters in late autumn. Furthermore, there were no spawning grounds in NAFO waters and the redfish in NAFO waters eonsisted mainly of so-called "upper-layer fish", with insignifieant quantities of redfish in the level below 500 metres.

In other words, there was no evidenee of a distinet redfish stock in NAFO waters. Nevertheless, there was a eertain movement from the NAFO side, whieh seemed to argue for a small but distinet NAFO redfish stock in those waters. However, it seemed that the NAFO Seientifie Council did aeknowledge that the redfish in NAFO Division 1F was "part of the oceanie redfish stock previously being distributed in the NEAFC Convention Area".

Nevertheless, it is also possible that these areas of redfish abundanee were not a new oeeurrenee but rather a new diseovery made when the surveys were extended.

What did beeome elear was that further researeh and enhaneed seientifie knowledge were needed.

Regulation of redfish in the North East Atlantic

For a number of years, fisheries for pelagie redfish in the Irminger Sea have been regulated and managed by NEAFC. For the first time in 1996, NEAFC established a total allowable eateh (TAC) with a TAC set at 153 000 tonnes for the NEAFC Convention Area, eovering fisheries both inside and outside the EEZs of the Contraeting Parties.

The six Contracting Parties of NEAFC all have different interests in this stock. It occurs mainly inside the EEZs of Greenland and Iceland and also in international waters. Historically, some of the Contracting Parties have established a long-term record of fishing activities in the areas in question. Others have contributed towards establishing a better understanding of the science of the stock by carrying out research over a number of years. So when the TAC and sharing was established, it was necessary to take into account all sorts of factors giving foundation to the claims of the various Parties.

Between 1996 and 1999, all Contracting Parties with the exception of the Russian Federation accepted the TACs and quotas established by NEAFC. Unlike other regulated species in the NEAFC context, the TACs for redfish in NEAFC have not been set according to the model of staged co-operation, whereby the coastal States first agree on restrictions for their own fisheries, with NEAFC establishing compatible measures for the high seas portion of the stock, as is the case for other stocks in NEAFC (Atlanto-Scandian herring and mackerel). Originally, the TAC was established for the NEAFC Convention Area, including the EEZs of both Greenland and Iceland. At the NEAFC Annual Meeting in November 2000, Iceland made it clear that they felt that it was preferable to have a quota system reflecting scientific advice, even though that advice is somewhat imperfect. From then on, they have established their own autonomous quotas. Nevertheless, the other Contracting Parties took due regard of Iceland's interest by leaving a proportion of the TAC unallocated both for 2001 and 2002.

The TAC for 2002 shared between all six NEAFC Contracting Parties is 95 000 tonnes, although this has not been acceptable to either Iceland or the Russian Federation. With a proposed quota in 2002 of 24 169 tonnes, the Russian Federation established an autonomous quota of 32 000 tonnes. Provision had been made for a possible quota in Icelandic waters for the same period of 27 008 tonnes for Iceland. They fixed autonomous quotas of 13,000 and 32 000 tonnes to be fished in two different areas. The Russian Federation is dissatisfied with the level of quota, which has been allocated to them, whilst Iceland has a fundamental difference of opinion on the method of management of the redfish in the North Atlantic.

In the meantime, ACFM had been asked to review the advice it had given for 2002 at its meeting in May 2002. The result of this review was that ACFM considered that the stock could sustain a maximum exploitation for 2002 and 2003 equivalent to current catch levels, which over the last five years have averaged 119 000 tonnes. Nevertheless, no change to the existing regulatory measure for 2002 has yet been agreed in the NEAFC context.

With the movement of the stock into NAFO waters, NEAFC has had every interest in ensuring that adverse effects for the stock as a whole were avoided.

What is the practical result of this change in the location of this redfish stock?

There is now legitimate scope for NAFO Parties to start fishing on this stock in its waters. This is despite the fact that both the assessment and the management of the stock have until now been the sole responsibility of NEAFC. Some NAFO Contracting Parties have seen this as an opportunity to acquire new fishing possibilities. They may even have been motivated to seek solutions for this problem, which would disregard the biological unity of the stock. Other NAFO Contracting Parties might have been expected to have some misgivings with NEAFC becoming the main stakeholder of a stock within a NAFO context. The whole situation gave rise to great controversy and potential antagonism between the Contracting Parties of the two fisheries organisations.

There were almost no precedents for a situation such as this one, where a fish stock straddles between the Convention Areas of two regional fisheries organisations. We know that certain tuna conventions do include special co-operation and consistency requirements for cases of overlaps with areas under regulation by other fisheries management organisations. Other than certain cases, such as that of southern blue-fin tuna, where there has been acquiescence of a regulatory priority for the organisation within which the bulk of the stock occurred, these requirements have not yet resulted in any formal arrangements.

The starting point in the discussion, which had to take place in both NEAFC and in NAFO, was the general co-operation and conservation obligations contained within the provisions of the UN Convention on the Law of the Sea (UNCLOS). Article 119 of UNCLOS makes it a requirement to *inter alia* take into account "fishing patterns", i.e. the presumption in favour of the established use of the redfish. Also relevant was the

"due regard requirement", which implies the respect of existing fishing rights and therefore the rights established already by the NEAFC Contracting Parties. Furthermore, we were also able to draw upon the general ideas, which underlie the compatibility provisions of the 1995 UN Agreement on Straddling Fish Stocks, inasmuch as the principles of the biological unity of the stock and the pre-eminence of established regulated fisheries are concerned. The exercise we had to carry out had to give real meaning to these obligations and principles in respect of the redfish as a whole.

Based on these considerations, it was possible to identify a number of possible management options:

1. Extension of the NEAFC regulation into NAFO waters (where NEAFC establishes the TAC for the entire stock - any catches made in NAFO waters count against NEAFC quotas;
2. Establishment by NEAFC of a TAC for the entire stock, setting aside an agreed specific percentage for treatment by NAFO;
3. NAFO and NEAFC separately regulate the portions of stock, which occur in their respective waters. The two quantitative restrictions would add up to the TAC for the entire stock; and
4. A temporary moratorium on fishing for redfish in the NAFO Division 1F pending the successful outcome of the joint NEAFC–NAFO process.

The latter option was only to be contemplated as a last resort in the event that a dispute arose between NEAFC and NAFO.

The third option would have constituted the "jurisdictional" solution. However, it would have presupposed a permanent occurrence of the NEAFC redfish in NAFO waters. It would also have required a lengthy process in order to accurately determine the respective portions of the stock and explain how to establish compatible conservation measures.

For NEAFC Contracting Parties, the first option was obviously the ideal solution. However, it might have been very acceptable to the NEAFC Contracting Parties but much less so in the broader NAFO forum. One option remained, namely option two. This would allow for both an agreed solution and a rapid completion of the process, at the same time being as close as possible to the biological reality of the stock.

What has happened since NEAFC and NAFO decided to cooperate and jointly examine this situation?

In February 2001, NEAFC and NAFO held a joint working group meeting in order to explore possible ways to co-manage the oceanic redfish stock. This was to help prepare a decision to be taken at the Special Fisheries Commission of NAFO in Copenhagen in March 2001.

NEAFC had already taken a decision for the regulation of the redfish for 2001 under its responsibility at its Annual Meeting in November 2000. A TAC of 95 000 tonnes was agreed upon despite an objection from Iceland.

In NAFO, regulatory measures were adopted for the first time at the Special Fisheries Commission meeting of NAFO in Copenhagen in March 2001. These were considered as ad hoc measures until a definitive solution could be found, which:

- did not prejudice either the interests of the NAFO Contracting Parties or of the NEAFC Contracting Parties;
- remained consistent with the cooperation obligations of customary international law; and
- recognized due regard for the existing NEAFC management measures.

The result agreed in March 2001 can be described as follows:

- The extension of the management measures adopted for the NEAFC Regulatory Area (95 000 tonnes)into NAFO Division 1F, provided that catches taken in NAFO Division 1F are deducted from the NEAFC quotas and that vessels comply with the technical requirements (mesh sizes etc.) in NAFO when fishing in this area;

- Despite the level of the TAC for 2001, a limit of 30 000 tonnes to be imposed on catches in NAFO Division 1F;
- NEAFC be given the task of carrying out the scientific assessment for the stock and establishing the overall TAC.

The final result in NAFO remained contentious as of the thirteen Contracting Parties present at the meeting, only nine supported the proposal outright. The other four had a number of concerns. One was unsure of having a single TAC for two different organisations. Another wanted a moratorium until clearer scientific advice could be provided. A couple of Parties were concerned that not all NAFO Contracting Parties were given access to this fishery. A number of NAFOP Contracting Parties (Latvia, Lithuania and the Ukraine) subsequently objected to the ad hoc arrangement. Lithuania even established an autonomous quota of 5 000 tonnes.

Due to the very uncertainty hanging over the oceanic redfish in the North Atlantic, NEAFC and NAFO have had to continue to cooperate in this same manner.

For 2002, with NEAFC once again having agreed a TAC of 95 000 tonnes for the redfish stock, the same ad hoc measure was agreed between the Parties in NAFO. Lithuania once again objected and established an autonomous quota, this time at a level of 8 000 tonnes.

For 2003, NAFO agreed at its Annual Meeting in September 2002 to continue along the same vein but with a revised ad hoc arrangement. The new arrangement allocates 25 000 tonnes of redfish to be shared between the NEAFC Contracting Parties. A further 7 500 tonnes are allocated to other NAFO Contracting Parties, who are not Contracting Parties in NEAFC. This was a dramatic increase from the previous "others" quota of 1 175 tonnes and should be seen as an attempt to accommodate objecting Contracting Parties, in particular Lithuania. Furthermore, in account of the movement of the stock, the NAFO regulation now covers the sub-area 2 as well as Divisions 1F and 3K. The whole arrangement reflects the revised management advice produced by ACFM for 2002 and 2003, which implied an increased NEAFC TAC of 119 000 tonnes for the two years in question.

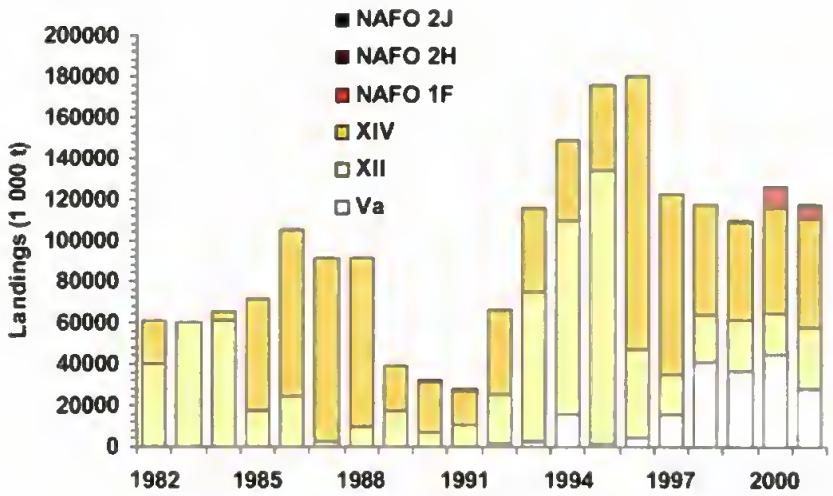


Figure 4 – International landings by ICES and NAFO divisions since 1982 as used by the ICES North-Western Working Group

Conclusion

In the North Atlantic, we have seen the need to cooperate on the pelagic redfish stock in the most appropriate manner possible.

The sharing of this stock is an interesting case to study in the sense that it is not only relevant as regards the sharing between EEZs and the high seas, but also in terms of sharing issues between adjacent regional fisheries organisations.

First of all, it has been necessary for the NEAFC Contracting Parties to cooperate amongst themselves. This has been done by the agreement on regulatory measures, which share out the stock, taking into account the legitimate rights of all the NEAFC Contracting Parties fishing in the Convention Area. By virtue of the distribution of the stock, this has necessitated a single regulation covering both waters under national jurisdiction, such as those of Iceland and Greenland, as well as international waters of the NEAFC Regulatory Area.

Having reached a limited arrangement within NEAFC, with the migration of the redfish stock, it has been necessary to cooperate on a much larger scale with NAFO, ensuring that any adverse effects for the stock as a whole could be avoided.

This has proved to be a very interesting and important exercise and demonstrates what can be possible in terms of co-operation between two neighbouring regional fisheries organisations, both of which have similar co-operation and conservation obligations for the fisheries in their respective areas.

ARRANGEMENT BETWEEN THE GOVERNMENT OF AUSTRALIA AND THE GOVERNMENT OF NEW ZEALAND FOR THE CONSERVATION AND MANAGEMENT OF ORANGE ROUGHY ON THE SOUTH TASMAN RISE

by

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NATURE OF THE EXPERT CONSULTATION

The introduction in the background concept paper makes the following statement:

> "The management of shared fishery resources remains one of the great challenges on the way towards achieving long-term sustainability".

The paper suggests the expert consultation should attempt to explore the problems facing both coastal states and distant water fishing nations in attempting to manage, on a cooperative basis, the classes of shared fishery resources. By sharing experiences of cooperative management, the expert consultation seeks to assist countries to improve their efficiency and performance in the management of shared fishery resources.

THE SOUTH TASMAN RISE ORANGE ROUGHY FISHERY

Background

This fishery has been described by the parties in the following ways:

- a fishstock that is found, both within a coastal state EEZ and the adjacent high seas. That is a straddling stock; or
- a fishstock to be found exclusively in the high seas.

This point of definition was a key issue of dispute during the early stages of the negotiations. The important issue for the purposes of this consultation is that cooperative action was taken for the conservation and management of the fishery.

THE SPECIES

Orange roughy (hohlostethus atlanticus coletle) is a bright orange fish that is commercially very valuable, bland tasting and perfect for freezing. Orange roughy is a popular choice for the US market. The value is approximately NZ$1 million per 100 tonnes. It is a demersal deep-sea species found on the continental slopes at depths of approximately 1000-2000 metres. Orange roughy occur in low densities on the flat seabed but during spawning season are found in large aggregations, often around sea mounts. Stocks are also often found in feeding aggregations again on the steep slopes of sea mounts. The large aggregations are attractive for fishing operators. In the past 20 years New Zealand, Australia and South Africa fishers have been at the forefront of designing and trialing technology suitable for the deepwater fishing which requires complex skills to allow the manoeuvring of nets around spiny pinnacles and steep valleys.

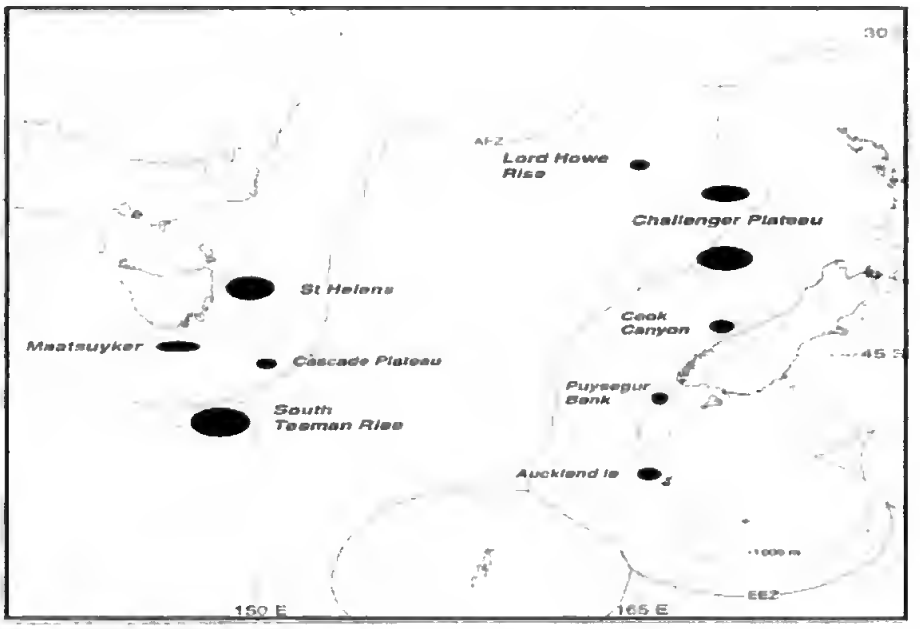
Orange roughy is one of the worlds most fragile marine resources. The species has a long life span, possibly up to 150 years. Maturity occurs at approximately 30 years. Their slow growth, low recruitment, long

period prior to reaching maturity and high value, are factors which contribute to the need for proper management and conservation measures. Without them, discrete stocks of orange roughy can quickly result in sharply declining catches. Several orange roughy fisheries within the New Zealand EEZ have been closed or TACs lowered to minimal levels to allow for stock rebuild.

GEOGRAPHICAL LOCATION

The South Tasman Rise is an area of sea mounts south of Tasmania. The Arrangement negotiated between Australia and New Zealand covers an area of the high seas adjacent to the Australian EEZ.

(Figure 1) ***The Mid Tasman Sea showing location of major New Zealand and Australian Fisheries for orange roughy***



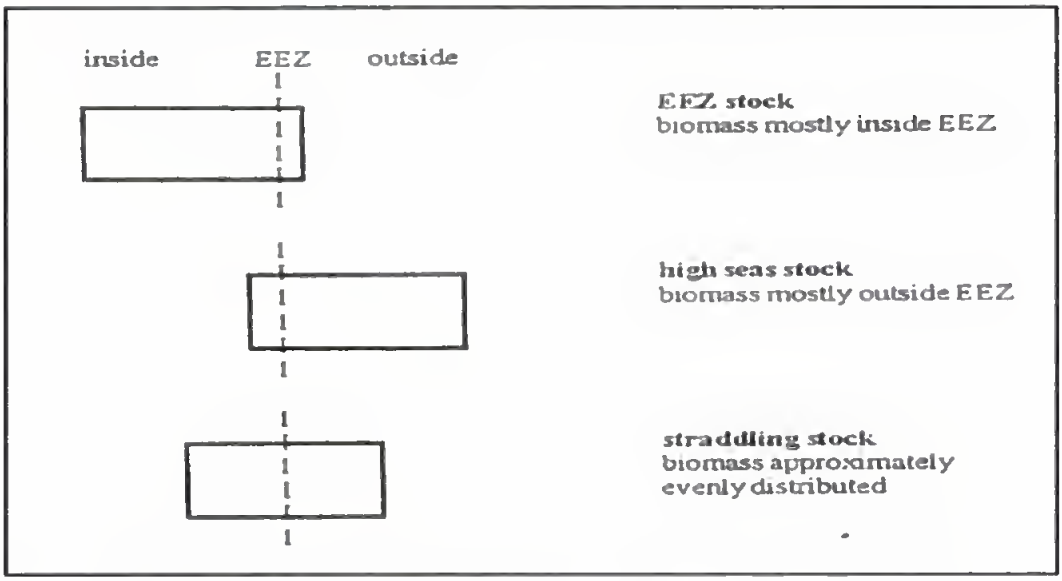
At the early stages of discussions much of the debate focussed on whether the stock actually straddled the Australian EEZ or whether it was a discrete high seas stock. This disagreement over the categorisation of the stock had implications for future management options. The underlying issue was whether Australia would be entitled to coastal state rights over straddling stocks, or if it, just like New Zealand, would need to rely on its flag state right to engage in fishing on the high seas.

Initial work by scientists was directed at identifying if the orange roughy within the Australian zone was the same genetic structure as that outside. Australian records showed that modest amounts of orange roughy had been caught within the zone but the commercial fishing was primarily on the sea mount structure on the high seas.
This issue acquired a greater significance because the initial position taken by Australia was a claim for exclusive rights to catch and manage the orange roughy fishery on the high seas area of the South Tasman Rise.

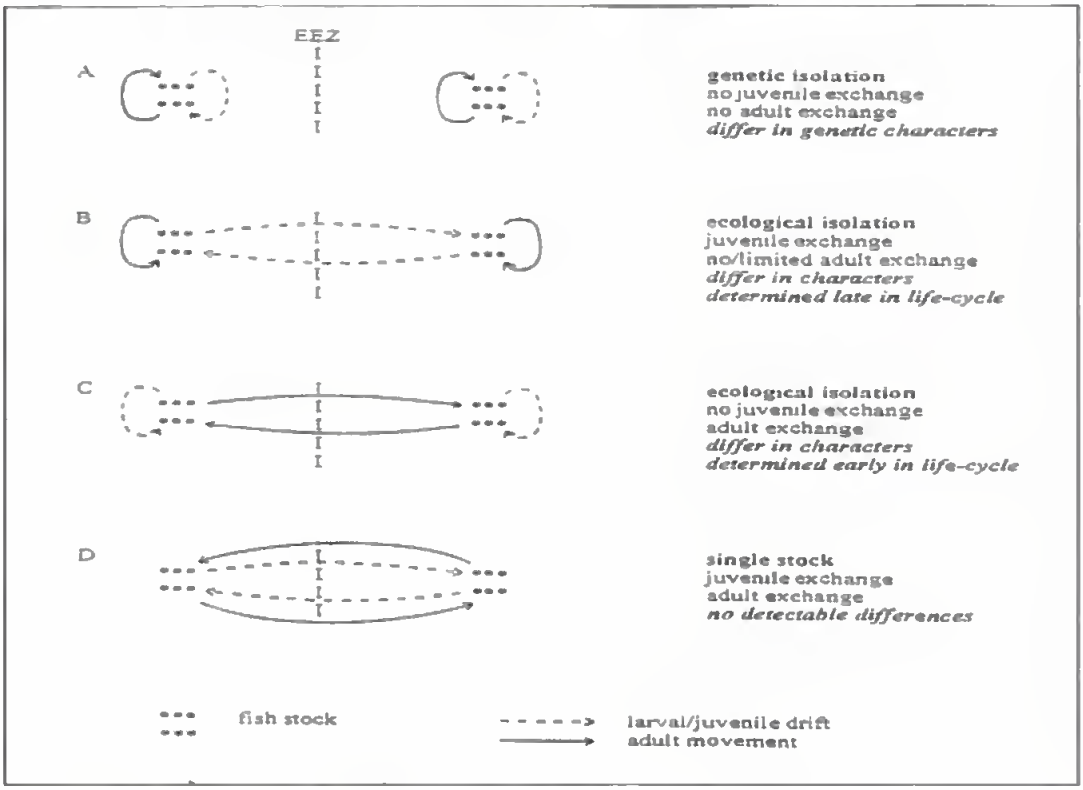
The attempt to resolve this issue was further hampered by the fact that neither the Law of the Sea Convention nor the 1995 Fish Stocks Agreement provides a definition for "straddling fish stocks".

A scientific framework for assessing biological data for defining straddling stocks was established. The framework had two components, firstly determining the stock relationships between fisheries inside and outside the EEZ, and secondly, for a single stock that straddles the EEZ, determining the biomass distribution to define the stocks as "EEZ" or "high seas" or "straddling stock".

(Figure 2) – ***Distribution of transboundary stock (adapted from FAO)***



(Figure 3) - ***Ecological and genetic stock structures for orange roughy straddling stocks.***



FISHING ACTIVITY – A CATALYST FOR ACTION

In late 1997 fishing activity increased over a short period of time. A number of Australian and New Zealand vessels were extracting large volumes of catch. The actual aggregation areas were small which meant fishing activity was occurring in a concentrated area. Officials from Australia approached New Zealand raising concerns about the sustainability of the resource and the need to find a way to manage the fishery. The New Zealand government responded by requesting New Zealand vessels to withdraw from the fishery until an effective management regime was developed.

The timing of the New Zealand withdrawal from the fishery and the continued fishing activity by Australian vessels was to prove to be an ongoing contentious issue through the first few years of the Arrangement.

WHY CO-OPERATE?

Who wanted what?

Australia had more to gain from cooperation. In the first set of consultations it was clear that the preferred option for Australia was to have:

- exclusive access to the high seas areas of the South Tasman Rise in return for which Australian vessels would not fish a small area of the Challenger Plateau adjacent to the New Zealand EEZ

The second option was to have an interim Arrangement developed swiftly to confirm Australian larger catch history in any allocation. Sustainability of the resource was a further consideration.

New Zealand was less enthusiastic about the development of cooperative management but clearly wanted continued access to the fishery and was also concerned about resource sustainability.

Other features played an important role in driving the development of the cooperative Arrangement.

Fishing and the management of fisheries resources cannot be considered in isolation to the wider relationship with another state. This is particularly so when the other state is a neighbour as is the case in cooperative transboundary management regimes. The relationship between New Zealand and Australia is obviously much richer and complex than any concerns about this specific fishery. The dynamics operating in this wider relationship can provide the catalyst for cooperation to succeed or fail.

A further feature played a role in allowing this regime to develop. Both New Zealand and Australia have generally held shared views on the use of stock assessment based on thorough scientific principles. Pride is taken in the robustness of sound fisheries management by both States. Neither State wished to risk their environmental credentials by allowing this fragile orange roughy fishery to be mis-managed.

In December 1997, Officials from New Zealand and Australia negotiated a one-year Arrangement effective from 1 March 1998 to conserve and manage orange roughy on the South Tasman Rise.

Features of the Cooperative Arrangement (Copy attached as Appendix 1)

Participants

The one-year Arrangement was between two States. There was no mention of other parties and clearly the issue of further membership was not anticipated. As such this first Arrangement had many of the features usually found in a cooperative transboundary regime rather than a straddling or high seas regime.

Terms

The specific objectives of this Arrangement were to carry out a programme of research to:

- provide clear information on the stock structure;

- obtain information to enable preliminary assessment of the status and productivity of the stock.

MANAGEMENT FEATURES

- A total allowable catch limit was set and proportions of this TAC were allocated to New Zealand and Australia based on verified catch history over the previous twelve months.
- Exchange of catch data and associated issues were agreed.
- Monitoring and reporting requirements were specified.
- A commencement date was specified which was several months after the signing of the Arrangement. This delay created complications during the implementation of the regime.

In summary, the Arrangement was bilateral, short term and with clearly specified management requirements. It was designed as a quick solution to solve an immediate problem but both parties acknowledged the need to create a longer term Arrangement for the future.

On the face of it, this cooperative fisheries management should have had a positive life with benefits to both parties and a healthy ecological sustainable outcome for the fishery.

Instead the first few years of management of this resource can be summed up by the following comments in a briefing paper in 2000 to the New Zealand Minister of Fisheries.

> ***"The differences between Australia and New Zealand over the Orange Roughy Fishery on the South Tasman Rise have been protracted and acrimonious with allegations and counter allegations of bad behaviour by respective fishing industries"***

At the end of the first year of life of the Arrangement, negotiations on the extension failed, largely due to an inability to reach agreement on how to resolve the problems that had occurred before and during the Arrangements one-year life.

The major area of dispute was how to address overfishing by Australia in the months between the signing of the Arrangement and its coming into effect and by New Zealand following the conclusion of the Arrangement and before a new Arrangement was negotiated.

From time to time the tension from this dispute spilled over into the wider bilateral relationship between the two countries.

During this period South African and a Belize-registered vessel arrived on the South Tasman Rise. After forthright diplomatic representations the vessels left the fishery. The presence of these vessels raised the un-addressed issue of provision for third parties. As stated previously the initial Arrangement had most of the characteristics of a transboundary cooperative fisheries management regime. It was ill equipped to deal with the necessary components of a Regional Fisheries Management Organisation for straddling stocks. Within most RFMOs a non-member, found to be fishing the stock in the high seas governed by the RFMO, in a manner inconsistent with the conservation and management measures is deemed to be engaging, not in illegal fishing, but in un-regulated fishing (Munro).

The Second ***South Tasman Rise Orange Roughy Arrangement*** (Appendix 2) was agreed in 2000. This Arrangement settled issues for over-catch and more specifically set out obligations to cover third parties. Cooperation with third parties was limited to countries "***which have a real interest in the conservation and management of Orange Roughy on the South Tasman Rise***". The issue of "***real interest***" is raised within the 1995 UN Agreement for straddling Fish Stocks and Highly Migratory Fish Stocks in Article 8 (3). The concept of real interest is not defined in the 1995 Fish Stocks Agreement nor has practice so far led to a widely accepted and uniform definition.

A further feature of the modified Arrangement was the requirement to notify the FAO of the Arrangement for the purposes of International publicity. During the period when South African flagged vessels were fishing, the South African government claimed no knowledge of the existence of the STROR Arrangement.

Subsequent to the 2000 Arrangement operating, catches by both parties have been well below the TAC and National allocation.

Additional elements have been added to the Arrangement to allow for more effective operation. The application of consistent management measures to the Orange Roughy stock within the Australian EEZ has occurred. A formal stock assessment process has been developed with scientific advice provided jointly to a bilateral management decision making group.

In reviewing this cooperative management several lessons could be further explored:

- Allocation to parties:
  A clearly stated basis for establishing catch history. This needs to be time bound and understood by all parties.

- Time consistency – the initial Arrangement had a short time frame, was rigid and limited in its purpose. This lack of flexibility undid much of the good will which was present in the early negotiations.

The New Member Problem

- The 2000 Arrangement included provision for new members but as yet has been untested with no formal request for third party membership.

Unregulated Fishing

- The parties used diplomatic channels to manage the fishing of non-members. This approach may prove unsuccessful in future and the parties may need to explore mechanisms to minimise the risk of unregulated fishing.

SUMMARY

The development of this Arrangement between two parties has many characteristics of those applied to the cooperative management of transboundary fishery resources.

The current equilibrium is maintained simply because the fishery is yielding small quantities of catch. It is not economically viable for third parties to travel vast distances when catches are uncertain. If the fishery was to rebuild and large aggregations of orange roughy were to be found it will be necessary for the parties to the Arrangement to address all the issues raised.

APPENDIX 1 1998

ARRANGEMENT BETWEEN THE GOVERNMENT OF NEW ZEALAND AND THE GOVERNMENT OF AUSTRALIA FOR THE CONSERVATION AND MANAGEMENT OF ORANGE ROUGHY ON THE SOUTH TASMAN RISE

The Government of New Zealand and the Government of Australia (The Parties):

Considering their shared commitment to the implementation of the relevant provisions of the United Nations Convention on the Law of the Sea 1982;

Recognising their shared concern for and commitment to the conservation of the living resources of the high seas;

Recognising the need for conservation and management measures to be established as a matter or urgency with respect to orange roughy stocks on the South Tasman Rise[1].

Mindful of the need to achieve as soon as possible an agreed understanding of the stock structure for orange roughy and other species taken on the South Tasman Rise, as this has clear implications for the way the fishery may be managed in the future;

Recognising also the need for scientific research on the status of the said orange roughy stocks;

Convinced of the need to apply the precautionary approach widely in the conservation, management and utilisation of the said orange roughy stocks

HAVE REACHED AN UNDERSTANDING on the following:

Definitions

1. For the purposes of this Arrangement:

Australian fishing zone (AFL) has the same meaning as the Fisheries *Management Act 1991 (Cth);*

high seas of the South Tasman Rise means the area lying outside of and adjacent to the AFZ in waters generally south of Tasmania and enclosed by the line:

(a) commencing at the point 48° 30'S, 150°E[2]

(b) running thence west along the parallel of latitude 48° 30'S to the point 48° 30'S, 146° 30'E;

(c) thence north along the meridian of longitude 146°30'E to its first intersection by the outer limit of the AFZ;

(d) thence generally easterly and north-easterly along the outer limit of the AFZ to its first intersection by the meridian of longitude 150°E;

(e) thence south along that meridian to the point of commencement.

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[1] The South Tasman Rise is the same feature as that depicted on some maps and charts as the South Tasmania Ridge.

[2] Geographical co-ordinates in this definition are in terms of the International Terrestrial Reference System which is maintained by the International Earth Rotation Service and for most practical purposes are equivalent to co-ordinates in terms of the World Geodetic System 1984 (WGS84)

Program of scientific research

2. The Parties will carry out a Program of scientific research from 1 March 1998 to 28 February 1999 to:

- provide clear information on the stock structure and relationship between orange roughy taken on the high seas and orange roughy occurring within the AFZ; and

- obtain information to enable a preliminary assessment of the status and productivity of the fishery.

3. For the purposes of this scientific research programme and the Parties accept that a precautionary total catch limit for the period specified in paragraph 2 will not exceed two thousand one hundred (2100) tonnes. The precautionary total catch limit of 2100 tonnes will be shared between the Government of New Zealand and the Government of Australia in the proportion of verified catches of orange roughy made by New Zealand and Australian vessels in the high seas area of the South Tasman Rise during the period 1 January to 17 December 1997. On current information, New Zealand catches are estimated at approximately 500 tonnes and Australian catches are estimated at approximately 1600 tonnes. Final catch figures, and hence shares of the precautionary total catch limit will be determined by 31 January 1998.

4. No more than half of the respective national catch limits so determined will be fished in each of two six calendar month periods from 1 March 1998 to 31 August 1998 and from 1 September 1998 to 28 February 1999.

5. The scientific research program for collection and collaborative analysis of scientific information under the program from the South Tasman Rise fishery and other potentially related fisheries will be developed by the Parties by mid-February 1998 and recorded in writing. It will focus on work to assist in provide a clear determination of stock structure on the South Tasman Rise, e.g.:

(a) Catch by location
(b) Length frequency
(c) Age structure
(d) Reproductive stage
(e) Morphometrics
(f) Stock genetics
(g) Otolith structure

6. The Government of Australia will ensure that compatible information is available from scientific research programs within the AFZ consistent with the scientific research program being carried out on the high seas area of the South Tasman Rise.

7. The Parties acknowledge that the methodologies developed through the scientific research program, including mutually acceptable criteria for determining whether or not a stock is a straddling stock, will assist in broader assessments of stock characteristics in the Tasman Sea region.

8. The Parties will prohibit fishing on the high seas of the South Tasman Rise except with the authorisation of the appropriate authorities in accordance with their respective national legislation, such authorisation only to be given for the purposes of implementing the said scientific research program and subject to the limits described in paragraph 3.

Exchange of Information

9. Without prejudice to any other arrangements between the Parties, the Parties will exchange all relevant scientific and fisheries information relating to orange roughy on the South Tasman Rise including associated species and bycatch and including samples.

10. Information exchanged pursuant to this Arrangement regardless of its form will be treated as being supplied in confidence and no information will be used except in the manner permitted by the supplying Party and subject to the freedom of information and privacy laws applicable to each Party.

Collection and Provision of Data

11. The Parties will ensure that their respective vessels permitted to fish on the high seas area of the South Tasman Rise will collect and provide the data and samples required by the scientific research program.

Monitoring

12. The Parties will ensure that their respective vessels will:

- Operate satellite based vessel monitoring systems (VMS) during any trip involving fishing on the high seas area of the South Tasman Rise;
- Report their position and catch on a daily basis to their national authorities when fishing on the high seas area of the South Tasman Rise;
- Retain on board all catch taken on the high seas area of the South Tasman Rise unless otherwise directed.
- Record catch in official log books on a shot-by-shot basis.

13. The Parties will each arrange for scientific observers to be placed on their own vessels in order to ensure the effective implementation of the scientific research program.

14. The Parties will ensure that dockside monitoring of unloading of catch from the high seas area of the South Tasman Rise takes place.

15. The Parties will determine appropriate arrangements for collaborative monitoring of fishing on the high seas area of the South Tasman Rise.

Landings

16. Existing national arrangements applying to Australian and New Zealand vessels fishing for orange roughy in relation to access to and catch landing at the other country's ports will continue to apply for the purposes of this Arrangement.

17. The Parties will prohibit the vessels of any State which is not a signatory to this Arrangement from landing in their respective ports orange roughy caught on the high seas area of the South Tasman Rise.

Review

18. The Parties will prepare a joint report on the outcomes of analyses of scientific information obtained through the scientific research program, with particular emphasis on the best available information in relation to stock structure, in time for a meeting to discuss future management options for the South Tasman Rise fishery by February 1999.

19. The Parties will meet in February 1999 to review these arrangements and consider a new conservation and management measures for orange roughy on the high seas area of the South Tasman Rise.

Commencement and Duration

20. This Arrangement will take effect from 1 March 1998. The Parties will use their best endeavours within their legislative framework to make regulations as are required to implement this Arrangement as soon as possible and will inform each other in writing when such regulations are in force. Should the regulations not be in force by 1 March 1998, the Parties will bring this Arrangement to the notice of their respective industries and will request voluntary compliance with its provisions.

21. This Arrangement will expire on 28 February 1999.

22. This Arrangement is without prejudice to any future arrangements or agreements the Parties may enter into with respect to Tasman Sea fisheries generally and/or orange roughy on the high seas area of the South Tasman Rise.

23. If, as a result of the collaborative scientific work undertaken under this precautionary management regime, the preponderance of evidence indicates that the orange roughy stock on the South Tasman Rise is a straddling stock occurring both within the AFZ and in the adjacent high seas area, the Parties will establish a consistent approach towards conservation, management and allocation for all straddling fish stocks in the Tasman Sea region, consistent with the United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks.

This Arrangement embodies the understanding reached between the Parties concerning fisheries matters on the South Tasman Rise.

ARRANGEMENT BETWEEN THE GOVERNMENT OF AUSTRALIA AND THE GOVERNMENT OF NEW ZEALAND FOR THE CONSERVATION AND MANAGEMENT OF ORANGE ROUGHY ON THE SOUTH TASMAN RISE

The Government of Australia and the Government of New Zealand (the Parties):

Considering their shared commitment to the implementation of the relevant provisions of the United Nations Convention on the Law of the Sea 1982 and their shared intention to become parties to the United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks 1995 (the 1995 Agreement);

Affirming their shared concerns for and commitment to the conservation of the living resources of the high seas;

Noting their previous Arrangements for the conservation and management of orange roughy on the South Tasman Rise;

Recognising the need for conservation and management measures to be maintained for South Tasman Rise orange roughy, and for those measures to be implemented at the domestic level by the Parties through effective and binding legislative controls;

Affirming the obligation to apply the precautionary approach widely to conservation, management and exploitation of fish stocks;

Mindful of the need to achieve as soon as possible an agreed understanding of the stock structure and abundance of orange roughy and other species taken on the South Tasman Rise;

Recognising also the need for continued scientific research on the status of orange roughy on the South Tasman Rise;

Acknowledging that the methodologies developed through a scientific research program for orange roughy on the South Tasman Rise, including mutually acceptable criteria for determining whether or not a stock is a straddling stock, will assist in broader assessments of orange roughy characteristics in the Tasman Sea region;

HAVE REACHED AN UNDERSTANDING on the following:

Definitions

1. For the purposes of this Arrangement:

   Annual catch limit in relation to a season means the whole-weight tonnage of orange roughy that a Party may take in that season in accordance with the formula in paragraphs 7 and 8;

   Australian fishing zone (AFZ) has the same meaning as in the *Fisheries Management Act 1991 (Cth);*

   high seas of the South Tasman Rise means the area lying outside of and adjacent to the AFZ in waters generally south of Tasmania and enclosed by the line:

   (a) commencing at the point 48° 30'S, 150°E1;

   (b) running thence west along the parallel of latitude 48° 30'S to the point 48°30'S, 146°30'E;

(c) (thence north along the meridian of longitude 146°30'E to its first intersection by the outer limit of the AFZ;
(d) thence generally easterly and north-easterly along the outer limit of the AFZ to its first intersection by the meridian of longitude 150°E;
(e) thence south along that meridian to the point of commencement;

quota in relation to a Party means the whole-weight tonnage of orange roughy in a season that is allocated to the Party in accordance with paragraphs 5 and 6;

season in relation to a year means a period of twelve months beginning on 1 March of that year and ending on the last day of February of the following year;

South Tasman Rise means the geomorphological feature as depicted on the map at Annex A.

Trawling and other demersal fishing only with authorisation

2. The Parties will prohibit trawling and other demersal fishing for all species on the high seas area of the South Tasman Rise except with the authorisation of the appropriate authorities in accordance with their respective national legislation, such authorisation only to be given for the purposes of implementing this Arrangement and subject to its terms.

Total Allowable Catch

3. Subject to any variation decided in accordance with paragraph 4, the precautionary total allowable catch (TAC) for each successive season for the duration of this Arrangement is two thousand four hundred (2400) tonnes whole weight.

4. The Parties may, taking into account the outcomes of the scientific research undertaken under this Arrangement and any other relevant circumstances, decide to vary the TAC from time to time. Such a variation will be effected by an exchange of Ministerial letters between the Parties.

Party Quotas

5. The TAC is allocated between the Parties in the following proportions:

Australia – 1800 tonnes, being seventy-five per cent (75%) of the TAC
New Zealand – 65 tonnes, being twenty-five per cent (25%) of the TAC

6. If the TAC is varied in accordance with paragraph 4, the Parties' quotas will remain in the same proportions as set out in paragraph 5, unless otherwise decided by the Parties and recorded in an exchange of Ministerial letters.

Annual Catch Limits

7. Unless the Parties jointly decide otherwise and record it in writing, a Party's annual catch limit for the 2000 season is equal to its quota. In each subsequent season, unless the Parties jointly decide otherwise and record it in writing, a Party's annual catch limit is calculated as follows:

(a) by adding to its quota for that season the amount, rounded to the nearest tonnes, by which its catch in the previous season fell short of its annual catch limit, up to a maximum of five per cent (5%) of its quota in the previous season, unless the TAC for that season is less than the TAC for the previous season; or
(b) by debiting against its quota for that season catch, rounded to the nearest tonne, taken by it in excess of its annual catch limit for the previous season (its excess catch) as follows:

(i) one tonne to be debited for each of the first 100 tonnes of excess catch; and

(ii) two tonnes to be debited for each tonne of excess catch thereafter.

8. If a Party's quota for any season is insufficient to absorb the amount to be debited under paragraph 7 (b), the Party concerned will debit any remaining amount against its quota for the following season, and any subsequent seasons as may be required.

9. Orange roughy caught in the high seas area of the South Tasman Rise will be debited against the annual catch limit of the Party that authorised the fishing irrespective of where the catch was landed.

Implementation

10. Each Party will implement this Arrangement through binding legislative or administrative mechanisms and will inform the other Party in writing of these mechanisms and of their entry into force. In particular, each Party will ensure that its annual catch limit is implemented in accordance with this paragraph with effect from the date of commencement of the relevant season.

11. Each Party will provide in its mechanisms pursuant to paragraph 10 that, when its annual catch limit for orange roughy in any season is reached, the high seas area of the South Tasman Rise is closed to all trawling and other demersal fishing for all species by its vessels for the remainder of that season.

Program of scientific research

12. The Parties will carry out a Program of scientific research for the purposes of:

(a) obtaining information to enable an assessment of the size of the stock(s) of orange roughy on the South Tasman Rise and of the sustainable yield; and
(b) providing further information on the stock structure and relationship between orange roughy found in the high seas area of the South Tasman Rise and orange roughy found within the AFZ.

13. Any fishing undertaken within the scientific research program will be taken within the TAC.

14. The Parties will develop a framework for the collection and collaborative analysis of scientific information on orange roughy and other related stocks on the South Tasman Rise, based on the scientific program instituted by the Parties under their previous Arrangements. The program will be reviewed on an annual basis and where necessary amended to achieve its purposes.

15. The Government of Australia will ensure that for scientific and management purposes information is made available from scientific research programs into orange roughy and associated species undertaken on that part of the South Tasman Rise lying within the AFZ consistent with the scientific research program being carried out in the high seas of the South Tasman Rise.

16. The Parties will ensure that their respective vessels authorised to fish on the South Tasman Rise collect and provide the data and samples required by the scientific research program.

Exchange of Information

17. Without prejudice to any other arrangements between the Parties, the Parties will exchange at least on a weekly basis all relevant catch and effort information relating to orange roughy and associated species in the high seas area of the South Tasman Rise when trawling and demersal fishing is occurring and until the fishery is closed. Each Party will notify the other Party in writing of the position whose occupant for the time being is responsible for the exchange of information under this paragraph.

18. The Government of Australia will advise the Government of New Zealand of the management measures and any changes to the management measures for orange roughy and associated species it

has adopted within the area of the AFZ adjacent to the high seas area of the South Tasman Rise. Aggregated catch data on such species will be provided on a three-monthly basis.

Confidentiality

19. Information exchanged pursuant to this Arrangement regardless of its form will be treated as being supplied in confidence and no information will be used except in the manner permitted by the supplying Party and subject to the freedom of information and privacy laws applicable to each Party.

Monitoring

20. Each Party will ensure that its respective vessels authorised under this Arrangement to fish in the high seas area of the South Tasman Rise:

    (a) operate satellite-based vessel monitoring systems (VMS) during any trip involving fishing in that area;
    (b) when fishing in that area report their position to their national authorities on at least a daily basis;
    (c) when fishing in that area report their catch to their national authorities on at least a daily basis and on a shot-by-shot basis once seventy-five per cent (75%) of that Party's annual catch limit has been taken;
    (d) retain on board all catch taken in that area unless required by their national authorities not to do so
    (e) record catch in official log books on a shot-by-shot basis; and
    (f) are notified immediately of the closure of that area to trawling and other demersal fishing.

21. Each Party will place observers on its own vessels at a level of coverage sufficient to ensure:

    (a) the effective operation of the scientific research program
    (b) the effective implementation of the terms of this Arrangement, including adequate and timely verification of catch data; and
    (c) where a vessel fishes both the high seas area of the South Tasman Rise and one or more other areas on a single trip, verification of the catch of orange roughy taken from the high seas of the South Tasman Rise.

22. Each Party will ensure that its appropriate authorities monitor the dockside unloading of catch at a level of coverage jointly decided by the Parties to be sufficient to ensure the effective implementation of the terms of this Arrangement.

23. The Parties will ensure that no transhipment at sea of catch taken in the high seas area of the South Tasman Rise is permitted within waters under their national jurisdiction or from their fishing vessels or fish carriers.

Landings and Port Access

24. Each Party's national arrangements in relation to access to its ports and landing there of catch by a vessel authorised to fish by the other Party will continue to apply for the purposes of this Arrangement.

25. Each Party will prohibit vessels not authorised under this Arrangement to fish in the high seas area of the South Tasman Rise from landing in its ports orange roughy and associated species taken in the high seas of the South Tasman Rise.

Cooperation

26. The Parties will cooperate in the surveillance of, and immediately exchange information on, fishing activities in the high seas area of the South Tasman Rise by vessels of third countries not signatories to this Arrangement and by vessels of the Parties not authorised to fish there.

27. Following consultation, the Parties will, where practicable jointly, approach the flag Stat of a vessel from a third country that by fishing in the high seas area of the South Tasman Rise undermines or threatens to undermine the effectiveness of this Arrangement, with a view to seeking that country's cooperation in the conservation and management of orange roughy on the South Tasman Rise.

28. Following consultation, the Parties, will, where practicable jointly, approach other countries with a view to deterring activities of vessels that undermine or threaten to undermine the effectiveness of this Arrangement. Such approaches will include seeking those countries' cooperation in deterring:

    (a) landing in their orts, and transhipment in waters under their jurisdiction, of orange roughy caught in the high seas area of the South Tasman Rise; and
    (b) transfer to the registers of those countries of such vessels.

29. Each Party will take all steps permitted by its domestic law to ensure that its nationals and companies do not engage in trawling or other demersal fishing in the high seas area of the South Tasman Rise with vessels not subject to the control of either of the Parties.

Third Countries

30. The Parties will cooperate with third countries which have a real interest in the conservation and management of orange roughy on the South Tasman Rise with a view to securing the application by them of the conservation and management measures of this Arrangement.

31. The Parties will jointly consider in terms of Article 11 of the 1995 Agreement any request by a third country referred to in paragraph 30 to become a Party to this Arrangement.

32. The inclusion of any new Party in this Arrangement will be effected by an appropriate instrument signed by all Parties which confirms the acceptance by the new Party of the understandings set out in this Arrangement and sets out the participatory rights of the new Party.

Commencement and Duration

33. This Arrangement takes effect on 1 March 2000. Any Party wishing to end this Arrangement will notify the other Party, at least 12 months in advance, of the date on which it is to cease.

Miscellaneous

34. Should any misunderstanding or differences arise between the Parties on the interpretation or implementation of this Arrangement, they will consult at the request of either of them with a view to resolving matters amicably and without unreasonable delay.

35. The Parties will jointly lodge this Arrangement with the Fisheries Division of the United Nations Food and Agriculture Organisation for the purposes of international publicity.

36. This Arrangement is without prejudice to any future arrangements or agreements the Parties may enter into with respect to Tasman Sea fisheries generally or orange roughy on the high seas of the South Tasman Rise.

This Arrangement embodies the understanding reached between the Parties concerning fisheries matters in the high seas area of the South Tasman Rise.

SOME SHARED FISH STOCKS OF SOUTH EASTERN PACIFIC

by

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INTRODUCTION

This paper is designed to provide an overview of major shared fish stocks, and their fisheries, in the South Eastern Pacific-SEP. The paper was prepared for presentation at the Norway-FAO Expert Consultation on the Management of Shared Fish Stocks. It will attempt to review the status of those small pelagic fish stocks, which can be classified as shared stocks, according to the definitions used by FAO, and others. In so doing, the paper will describe the main biological aspects of the stocks, their legal status, and will describe the efforts of Peru and Chile, as the most important fishing countries in the Region sharing these resources, to integrate their studies on the resources. Finally, the paper will attempt to outline the scope and magnitude of the future relevant cooperative resource management issues in the South Eastern Pacific Region.

SHARED FISH STOCKS

According to Munro's discussion paper, prepared for the Norway-FAO Expert Consultation, "shared fish stocks" can be defined to include the following:

Fish resources crossing the EEZ boundary of one coastal State into the EEZ(s) of one, or more, other coastal States – transboundary stocks.

Highly migratory fish stocks, which, due to their highly migratory nature, are to be found, both within the coastal State EEZ and the adjacent high seas

All other fish stocks (with the exception of anadromous/catadromous stocks) that are to be found, both within the coastal State EEZ and the adjacent high seas – straddling stocks

Fish stocks to be found exclusively in the high seas

The Norway-FAO Expert Consultation is to focus its attention on categories (a) and (c) stocks, i.e. transboundary and straddling fish stocks.

We also take note of John Caddy (1997) definition of transboundary stocks, which, as Munro points out, can be extended, with minor modification, to cover straddling stocks:

A group of commercially exploitable organisms, distributed over, or migrating across, the maritime boundary between two or more national jurisdictions, or the maritime boundary of a national jurisdiction and the adjacent high seas, whose exploitation can only be managed effectively by cooperation between the States concerned ----

TRANSBOUNDARY FISH STOCKS IN SEP

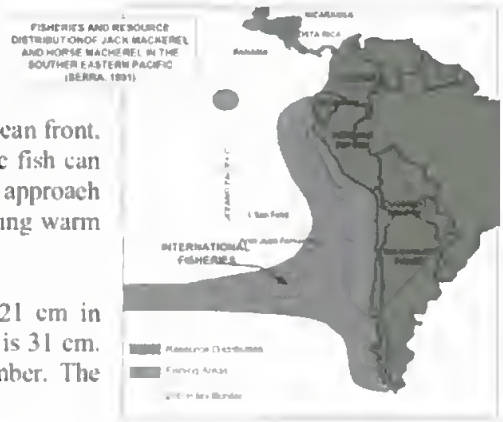
Recent reports on the fishing activities in the Pacific South Eastern countries show that there are several species, which can be classified as, transboundary fish stocks, in that they are to be found in two or more EEZs (Annex I).

Of these species, some will have to be managed strictly within the Southeast Pacific Region, while others are, and will be, regulated by International Organizations, the jurisdiction of which extend well beyond the Southeast Pacific. An example is provided by the main tuna fish species in the Region, which are regulated by the Inter-American Tropical Tuna Commission (IATTC).

Since the Norway-FAO Expert Consultation will not be considering highly migratory stocks, the relevant shared fish stocks of the South East Pacific are the pelagic resources, shared by two or more countries. These are: Jack Mackerel (*Trachurus picturatus murphy*), Anchovy (*Engraulis ringens*), Sardine (*Sardinops sagax*), Giant or Jumbo flying squid (*Dosidicus gigas*) and swordfish (*Xiphias gladius*). Some of the resources, as well as being shared by two or more coastal states in the SEP Region, also extend in to the high seas, adjacent to the coastal state EEZs.

BIOLOGICAL ASPECTS OF MAIN FISH STOCKS

Jack Mackerel (Trachurus picturatus murphy)



This is a migratory pelagic species, which moves in large schools, of similar size, along the coast, and beyond the 200 nautical mile outward boundary of the EEZs. The fish, which can grow to a length of 70 cm, finds it habitat in the ocean front, consisting of cold coastal and subtropical surface waters. The fish can also be found, however, in waters as deep as 300 m. The fish approach the coast during the summer, as well as in other seasons during warm years.

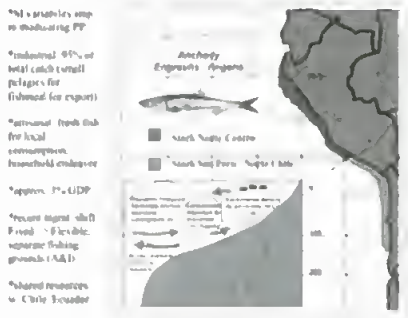
The fish can achieve maturity, when they have grown to 21 cm in length; although the average length upon achieving maturity is 31 cm. Spawning occurs during the months of October and November. The minimum allowed catch size is 31 cm.

Anchovy (Engraulis ringens)

The species is to be found from Punta Aguja, in Peru (5° 50´S) to Lota, in Chile (37° 04´S. L.). It is a pelagic, and mostly coastal, species (within 50 nautical mile), although it is occasionally found beyond 100 nautical miles, particularly during winter. The species move in large schools in waters of up to 50 m. in depth that are associated with temperature (14.5 °C and 21°C) and water salinity levels of 34.5 and 35.1 PSU. On rare occasions, weather-ocean alterations will drive the anchovies into deeper waters (more than 70 m.). Under normal environmental conditions, the fish can achieve first sexual maturity upon attaining a length of 9 to 10 cm, that is to say when they are near one year- old. On average, maturity is achieved at length 12 cm. The fish can live from three to five years, and can grow to a length of 18 to 20 cm.

The fish spawn throughout the year, although the primary spawning season occurs between August and October. There is a secondary spawning period between February and March. The beginning and the end of the spawning period greatly depends on both weather conditions and the maritime region. The Peruvian anchovy spawns at 6°S, mostly in the areas of Chicama-Chimbote, Huacho-Callao and Tambo de Mora-Pisco, close to the coast.

There are two large stocks: One in the northern-central area of Peru (Punta Pariñas-San Juan), and the other in southern Peru and northern Chile (where we can find two sub-populations: one distributed between Atico and Antofagasta, and the other between Antofagasta and Valdivia).



The Peruvian anchovy mostly feed on plankton. They are, in turn, predated upon by guano and island birds, the seals, along with other species such as tuna, the Eastern Pacific bonito and whales. The minimum allowable catch size is 12 cm, and a 13 mm or ½ inch mesh size is used for fishing purposes.

Sardine (*Sardinops sagax*)

This is a pelagic species that moves in schools, and which moves between the coastline and the 200 miles limit. During the day, it can swim into deep waters, up to 80 m. in depth. The fish can live for more than 10 years, and can reach a length of over 33 cm. The species is associated with temperatures that fluctuate between 14° and 25°C and salinity levels ranging from 34,8 to 35,3 UPS. Its growth, weight and fat content may by affected by environmental changes

The species has a high fertility rate, reaching sexual maturity when it is 2 years old approximately (15 – 20 cm). It spawns in the open sea, and does so more intensively under ocean changes associated with the "El Niño" phenomenon.

There are two areas where the stocks occur: off the northern-central coast of Peru, and the other off the coast of southern Peru-northern Chile. Another stock is to be found in the area surrounding the Galapagos Islands, off Ecuador.

Jumbo Squid[1] (*Dosidicus gigas*)

This is an oceanic and neritic species, which is to be found up to a depth of 500 m. It is the most abundant and largest of the South American pelagic species. The adults are found in water temperatures of between 26 and 28°C to lower temperatures, which are to be found in nearshore waters, near the surface, both during the day and night. In the Gulf of California a single stock has been identified, composed of several cohorts. Its seasonal migrations have been described by Ehrhard *et al.* (in press), which is similar to those of other ommastrephids. The cohorts grow at different rates, depending on the environmental conditions at the time of hatching. All recruit to the fishery around May of each year. The fish in the Northern Hemisphere stocks normally live for about one year. After spawning, the mortality rate is high. The species feeds on larvae of pelagic fishes, such as lantern fishes, sardines, mackerels and saurics, and on crustaceans. Cannibalism is very common. The species is, in turn, predated upon by swordfish, sharks, porpoises and other mammals.

Exploratory fishing for this species was started in the early seventies in several areas along the Pacific coast of America. While the operations by Japanese vessels off Chile were discontinued because of insufficient landings, Mexican catches increased from 14 t in 1974 to over 19 000 t in 1980. The Mexican harvests subsequently declined to about 10 000 t in 1981 (FAO, 1983), and to even lower levels in the 1982-83 fishing season. Through a joint venture scheme, most of those catches have been taken by Japanese jigger boats, and by Mexican shrimpers that switch to squid fishing during the closed season for shrimp fishing. The best catches are experienced during summer time, but the season has gradually expanded, so that fishing now occurs throughout the year. Jigging operations are enhanced during the night by light attraction. Sports fishing for the species off the southern Californian coast has a quite limited importance. This squid is mostly used as bait, although some of it is used for human consumption in dried form. In Chile, small amounts are marketed canned. A market for frozen filets has recently been developed in the western USA. Total catches reported for this species to FAO for 1999 was 134 773 t. The countries reporting the largest catches were Mexico (57 985 t) and Peru (54 652 t).

[1] Information from: FAO/SIDP Species Identification Sheet: Dosidicus gigas (www.fao.org/fiserviet/org.fao.fi.co…)

Swordfish[1] **(*Xiphias gladius*)**

This is a resource, which supports large fisheries in all oceans of the world. A significant amount of the Pacific catch is taken incidentally in longline fisheries, targeting tunas. Recent landings have averaged around 34 000 metric tons. Japan, Taiwan (Province of China) and the United States account for about 70 percent of current reported production, with Mexico, Ecuador and Chile providing the remainder. In the eastern Pacific, swordfish are primarily harvested through the use of longlines, driftnets and hand-held harpoons.

The status of swordfish in the Pacific is not clear. Assessment studies often produce conflicting results. The most recent assessment studies suggest that swordfish comprise a single, continuous stock throughout the Pacific, with areas of high and low abundance. Genetic evidence indicates swordfish off the western coast of the Americas mix with fish from the central and western North Pacific. A second theory suggests the possibility of the existence of three or more stocks based on areas of high abundance, with fish then spread evenly over areas of low abundance.

Both theories indicate that the Pacific stock(s) of swordfish are relatively healthy, and they are being exploited at levels below maximum sustained yield. However, recent fishery statistics are not available, which means that the conclusions about the healthy state of the resource(s) are based upon out of date data.

Both the management, and current assessments, of the resouree(s) are based on old and incomplete data. New assessments, using updated and standardized fishery statistics, are needed to determine stock condition and to validate current estimates of maximum sustainable yields. International standards for this purpose are currently being developed.

CURRENT STATUS OF SEP SMALL PELAGIC FISHERIES

At present, these stocks are managed on a country by country basis in the SEP. Peru and Chile, the chief fishing countries in the Region, have sets of regulations for their respective shares of the fisheries. A brief description of the state of the fisheries, and the regulations follows:

In Peru, according to its General Fisheries Law, the purpose of management is to regulate fishing activities in order to promote the continued development of the fisheries as a source of staple food, employment and income. The goal is to ensure a reasonable exploitation of the natural resources, to optimize the economic benefits from the fisheries, as well as to conserve the environment and biodiversity.

The State, according to the type of fishing ground and the state of the exploited resouree, shall establish a system of regulations, which harmonizes the principle of protection and conservation of fishing resourees in the long term, with the attainment of the maximum economic and social benefits.

The regulations referred to shall include, if applicable: access regulations, total allowable catch, restrictions on fleet capacity, fishing and closed seasons, minimum size of the species, prohibited or reserve zones, appropriate fishing techniques, equipment and fishing systems. As well, the regulations stipulate the necessary monitoring, control and surveillance procedures.

The provisions adopted by the State to ensure the conservation and rational exploitation of fishery resources shall be applied to resources, beyond the 200 nautical mile boundary, that migrate towards the from the 200 mile zone to the adjacent waters, or that move from these adjacent water towards the coast in search of food, or for reproduction or breeding purposes.

Peru is eager to enter into agreements and international treaties with other countries, for the purpose of ensuring compliance with the provisions of the General Law of Fisheries, and the strengthening the principles of responsible fishing.

[1] Fisheries Resources Division, Southwest Fisheries Science Center. (http://swfsc.ucsd.edu/)

Jack Mackerel

In Peru, artisanal and industrial fleets eateh jack mackerel. The first one uses small boats, which operate in areas near the base ports. Industrial fleet uses purse seine nets, and vessels referred to as "bolicheras", whieh have a hold capacity greater than 30 tons. Some of the vessels have refrigeration system on board (RSW). These vessels eapture jack mackerel as a byeateh, sinee normally they are targeting sardine or anchovy resources.

From 1990-2000, the harvests averaged 200 thousand tons. From 1995 to 1998, however, the harvests were up to 300 thousand tons, due to a greater availability of the resouree and an inerease in the fishing effort of the boats with RSW, whieh are dedieated to fishing this speeies. The main management regulations refer to minimum mesh size (38 mm or 1½ ineh.) and minimum harvesting size (31 em length).

Anchovy

Anchovy harvest, whieh sustained the Peruvian pelagie fishery during the deeade of 60', deelined drastically in 1972, and stayed at low levels for more than ten years. Harvest increased after the El Niño 1982-83, and reached a maximum level of 9.7 million tons in 1994, a level which was the highest sinee the eollapse of the fishery in 1971 - 1972. Harvest fell after the El Niño of 1997-98, but this decline was followed by a rapid recovery in 1999 and 2000.

The speeies has been deelared as fully exploited. The main fisheries management measures are: Total Allowable Cateh, minimum harvesting size and reproduetive elose seasons.

Sardine

Analysis of historieal time series data of sardine eateh and seawater temperature, indieate that variations in eateh yields are eorrelated with shifts between cold and warm periods. In warm periods, the sardine eateh yields inerease, while anehovy eateh yields decline.

Globally, the populations of sardine and anehovy have displayed large fluetuations in their abundanee in all regions in whieh they both eoexist and have generally been fished heavily. Frequently, the anehovy population was abundant, when the sardine population was low or deelined and vice versa. These joint population shifts, referred to as "Regime Shifts", are assoeiated with shifts from warm environmental periods, to eold ones, and baek again.

In Chile, under the General Law of fisheries and Aquaeulture, the Ministry ean by exeeutive deeree, in each fishing ground, independent of the aeeess system to whieh it is subject, establish one or more prohibitions or measures for managing aquatie living resources. The Ministry's deeisions would usually be based on a teehnieal report from the Underseeretariat, eonsultations with the appropriate Zonal Fisheries Council, and other reports.

Various management measures are applied in Chile: closed seasons for speeifie speeies in specific fishing grounds. The elosures shall be applied seeking due concordance with the polieies applied by neighbouring countries. Prohibitions, temporary or permanent, of eatches of species proteeted by international agreements, whieh Chile has signed. Setting annual eatch quotas by species in a speeifie fishing ground. Deelaration of specifie, delimited grounds that shall be ealled Marine Parks, intended to eonserve eeologieal units of scientific interest and to safeguard areas that assure the maintenanee and diversity of living aquatie speeies, as well as grounds assoeiated with their habitat.

Also, in every fishing ground, independent of the aeeess system to which it is subject, the Undersecretariat, ean by deeree, based on a technieal report from the appropriate Zonal Fisheries Counеil, establish one or more of the following prohibitions or measures for managing living aquatic resources: Set minimum harvesting sizes by speeies in a specific area and their toleranee margins. In no ease shall the minimum size be smaller than the eritieal size. Set dimensions and eharaeteristies of fishing gear and deviees. It is forbidden to earry out extraetive fishing aetivities in violation of the provisions in these regulations. Harvesting aetivities are prohibited with gear, deviees and other fishing implements that adversely affect the

bottom of the sea in the territorial sea within an area of one marine mile, measured from the baselines from the northern limit of Chile to the 41° 28,6' latitude south, or within the Inland Sea, as the regulations determine, except for the one-marine-mile strip of sea measured from the low tide line of the continental coast and around the islands.

Since 2001, the main fisheries in Chile have been subject to TACs. In February 2001, the system of Maximum Limit of Capture was established, within the framework of Law 19.713.

Jack Mackerel

The jack mackerel resource is heavily exploited in all regions of Chile between Regions I and X and in particular, Regions III, III-IV, V-IX and X.

The total landings of jack mackerel in 2001, were 1,64 million t marking an increase of a 32.7 percent over the landings for 2000. The landings accounted for 39.9 percent of the total Chilean landings.

Anchovy

The resource was declared to be fully exploited in all Regions between I and X. The landings of anchovy for 2001, were 734 600 t, which were 56,8 percent below the 2000 landings. The 2001 landings accounted for 17,6 percent of total Chilean landings for that year. Most of the landings, 598 300 t, took place in Regions I and II, representing 81,5 percent of the total landings of anchovy. The Regions I and II landings were 50.2 percent below the 2000 landings.

Sardine

The total landings of sardine in 2001, reached 13 200 t, a level which was 77,4 percent below the 2000 landings. Sardines only account for a minor part of total pelagic landings (0.4 percent). 81.1 percent of the landings occurred in Regions I and II. These landings were 77,8 percent below the 2000 level. Regions III and IV registered landings of 1 200 t, which was 20.4 percent above the 2000 landings.

Of the TACs for Regions III and IV, the industrial sector accounted for 32,1 percent, (1 961 t), while the artisanal sector accounted for 41.8 percent (1 277 t).

EXPERIENCE IN COOPERATION

CAPMAD-SELA Project

A working Party on Marine and Fresh Water Products, convened in August 1978 under the auspices of CAPMAD-SELA, with experts from Ecuador, Peru and Chile to consider a joint study of the pelagic resources in the East Pacific Ocean. The working party set out the terms of reference for an investigation referred to as an "Assessment of Sardine, Jack Mackerel and Horse Mackerel Resources in the East Pacific Ocean". An agreement between the International Development Bank (BID) and the Permanent Secretariat of SELA, acting on behalf of the three international governments concerned, was signed in 1981.

The work commenced in October 1982, with courses on acoustic stock estimation and populations dynamics, designed to standardize methodology and data reporting. Field studies and data analysis culminated with a plenary session in Lima in June 1984. The plenary session produced a final comprehensive report. A short version of the report was published. The short version addressed the main problems in management of the pelagic resources in the South Eastern Pacific Ocean, and presented the principal results of this three nation cooperative study.

It can be remarked that this was the first time that such a coordinated study had been undertaken by three nations spanning the South American Pacific coastline, from about 1° N to 30°S.

The report presents a fairly broad description of the oceanographic features and circulatory pattern of the area investigated, in recognition of the fact that climate and oceanographic conditions drive the biological

production systems along the relevant coastline. The report also presents a synopsis of all contemporary knowledge on the three species; sardine (Sardinops sagax); Jack Mackerel (*Trachurus murphyi*) and Mackerel (*Scomber japonicus*). Some of the vital parameters of the resources are included, such as total biomass and its distribution, and patterns of entry into the fishery. These parameters represent some of the central elements of a real-time management system.

Great emphasis was placed on Synoptic acoustic surveys of the relevant coast line. One distinct contribution of this project was completion of a software package for the analysis of acoustic signals, regardless of whether they originated from analog or digital integrators.

A part of the report was devoted to the population dynamics of the three species in question, with special emphasis on mortality rates, natural as well as fishing, yield calculation and some first approximate estimates of safe minimum spawning biomass levels. Finally, a flow chart was presented with algorithms, which will enable any manager to achieve the established goals, by adjusting fishing time throughout the season.

Thus, the basic structure of a real-time management system was produced, and was seen as the main contribution of the SELA/BID investigations towards a first attempt to create a unified management system, which has appeared in the open literature.

One significant observation that was added, namely that the decision making process was based only on biological evidence. In real life, of course, management decision making must take into account economic, social and political objectives formulated by the respective national governments.

GALAPAGOS AGREEMENT

The CPPS countries (Colombia, Ecuador, Peru and Chile) have to administer some of the world's biggest fishing grounds, and have adopted effective measures to promote the long-term sustainability of the living marine resources in the Region. Due to the fact that these countries have a special interest in ensuring that the measures applied on the adjacent high seas are no less strict, than those applied in the zones under their jurisdiction, the four countries signed an agreement called the "Framework Agreement for the Conservation of Living Marine Resources on the High Seas of The Southeast Pacific", or 'Galapagos Agreement'.

The stated objective of the Agreement is the conservation of living marine resources in the high seas zones of the Southeast Pacific, with special reference to straddling and highly migratory fish populations. Although the Agreement applies to the high seas, the Agreement is, at the present time, not open to signature by non-coastal States.

The Agreement applies "exclusively" to the high seas of the Southeast Pacific. The relevant high seas area is bordered by the outer limits of the coastal States' national jurisdiction zones and a line following the 120-west meridian longitude, from the latitude of 50^0 north to the latitude of 60^0 south. It does not apply to the zones under national jurisdiction corresponding to oceanic islands belonging to any of the coastal States, but is does include the areas of high seas surrounding and adjacent to these oceanic islands, within the limits described.

The Agreement applies to straddling and highly migratory fish stocks. Particular species will have to be identified as being of "high-priority" at the first Meeting of the Parties.

An organization is to be set up under the Agreement, consisting of the following: a Commission, charged with adopting the necessary decisions for the fulfillment of the Agreement's provisions; a Scientific-Technical Committee to serve as an advisory body for the Commission on these matters; a Secretariat, along with any other subsidiary bodies that the States Parties or the Commission decide to establish, in support of the Agreement's implementation.

Currently the Agreement has not yet entered into force, but it does represent an important step towards establishing an effective framework for the conservation of the living marine resources of the South Eastern Pacific Ocean.

WORKING GROUP ON SMALL PELAGIC FISHERY (IMARPE-IFOP)

Peru and Chile, needing to know more about the major resources, which they share, have established regional co-operation at the scientific level. Under this cooperative arrangement, IFOP and IMARPE organized regional workshops on the joint assessment of sardine and anchovy stocks of Southern Peru and Northern Chile, The latest assessment took place in November 1999. IFOP is Chile's Fisheries Research and Development Institute. IMARPE is Peru's Marine Resources Research Institute.

These workshops were attended by senior scientists and resource managers from both countries. In some workshop there was representation from industry as well.

The following reproduces the findings of the latest workshop in 1999, and describes the state of the resources and the fisheries at that time. The state of the resources is much the same today.

THE CASE OF SARDINE AND ANCHOVY STOCKS

The fishing industries off southern Peru and northern Chile are supported by small pelagic species like sardine and anchovy. This area is one of the most productive marine areas of the world, and is located within the FAO Statistical Fishing Area N° 87. The Peru-Chile fishing area owes its high productivity to a system of oceanic currents known as the Humboldt Current, which is associated with an upwelling of nutrient rich waters. These stocks are harvested by vessels from Peru and Chile, within their own respective EEZs. The harvested fish are then sent to their respective fishmeal processing plants in the two countries.

In the fishing areas of each country, anchovies are confined to areas within 20 nautical miles of the coast, while sardines are frequently found from 20 to 80 nautical miles off the coast.

At present Peru and Chile are implementing, on an independent basis, fisheries policies to manage their living resources. The management policies are largely biologically based. Since 1992, however, the two countries agreed to conduct joint investigations of shared stocks of sardine and anchovies. The results of the last Workshop, held in 1999, enables us to review the development of these fisheries.

Sardine Fishery

The sardine resource is distributed between the latitudes 15°S (South of the Peru) and 24°S (North of Chile), and is considered to be a single stock. This stock, along with the anchovy stock, supports the main fisheries of both countries in this area. The sardine landings in both countries increased until 1985, as did the total landings in each country. After 1985 the landings decreased sharply until 1997. There was a slight increase in landings in 1998 and 1999.

During the last 5 years, the annual volumes of harvest of sardines have fluctuated in the south of Peru between 254 000 t. and 44 000 t. The peak was reached in 1997, and the trough in 1998. In the north of Chile, on the other hand, the smaller trough occurred in 1997, with 4 000 t, and the peak was reached in 1999, with 306 000 t. An important fraction of this harvest consists of small fish, mainly in the first semester of every year.

Anchovy Fishery

In 1996-1999 period, remarkable environmental changes occurred in the coasts of Peru and Chile, such as the "El Niño" of 1997-98, and "La Niña" in 1996 and 1999. Both affected the population of anchovies, and the anchovy harvests in the region.

In 1997, in the South of Peru recorded the largest landing of anchoveta in the last 25 years, landings which exceeded one million t. In 1996, on the other hand, the region recorded one of the smallest landings of anchoveta over the last fifteen years.

In the North of Chile, the 1997 catch was one of the greatest on record, whereas the 1998 catch was one of the smallest in 10 years.

The fishing administration in the south of Peru has not instituted close seasons, since August of 1997. Chile, however, regularly establishes recruitment and reproductive time closed seasons. During the period 1996 - 1998, the length of the closed season was increased from 37 to 147 days per year.

Analysis of geographical distribution of captures of anchovy by purse seiners fleet in the south of Peru, indicates that, in 1997, the largest percentage of the catch was taken between Ilo and the Southern end, whereas in 1996 and 1999 the distribution of the harvests was more widespread, the reverse of what occurred during "El Niño" 1997-98.

In the North zone of Chile, in 1997, changes in the distribution of anchovy were detected. The resource was found to be concentrated in an area within the 20 nautical miles of the coast. In 1998, Peruvian and Chilean fleets fished with 20 nautical miles of the coast. Along the rest of the coast, there was a noted absence of fish shoals.

The hydroacoustic cruises off the north of Chile in 1998, recorded a change in the distribution of the resource, similar to that which occurred in Peru. The shoals of fish were located between 20-m. and 45 m. levels in July 1997.

The biomass estimates of anchovy in 1996-1999 , based on the acoustic method, show an important increase of biomass in the south of Peru between April 1997 - July 1998, and in the north of Chile between November of 1996 and January of 1998. After that period, the biomass in both countries steadily declined, and remained at these lower levels, until April of 1999 (fig. 5). The increase of the biomass in the South region of Peru, reached a maximum of 1,5 million t. in April 1997. This change was probably related to the migratory movement of the stock, from north-center of Peru towards the South zone of the Peruvian coast.

The fishing effort indicators showed an increase in fishing effort during the years 1984-1999, reaching maximum levels in 1995 and 1997, Fishing effort has declined over the last few years. The standardized index of catch per trip reached a maximum in 1985, and then declined until 1991. Since 1991 the index stabilized at levels between 40-70 t/v, with the minimum occurring in 1998.

MANAGING TRANSBOUNDARY STOCKS OF SMALL PELAGIC FISH: PROBLEMS AND OPTIONS
(World Bank Discussion Paper No. 329; by Exequiel Gonzalez, Max Aguero)

With regards to these fisheries, this important analysis tests the hypothesis that appropriate joint management of transboundary fish stocks can help avoid to over exploitation of these resources, while increasing rents and other benefits. The study focuses on the industrial pelagic fisheries of northern Chile and southern Peru, and presents various quantitative models for identifying industry characteristics and for calculating benefits from the fisheries. From this study, we can draw several conclusions about the benefits to be gained from several alterantive joint management schemes.

The conceptual framework of the Agüero and Gonzales analysis can be summarized as follows:

Model specification

A mathematical programming model is employed to estimate the order of magnitude of the potential benefits for Chile and Peru, from different management alternatives. The basic components of the model are:

The transboundary stock (Spanish sardine and anchovy)
The fishing industry (fleet and processing plants)
The socioeconomic and technological setting.

The dynamic elements of the model used are as follows:

The population dynamics function (state equation)
The behavioral objective function of the industry

A set of coefficients and parameters describing the characteristics of the market variables, technology, socioeconomic behavior and institutional parameters.

Five alternative management scenarios are analyzed. The first three represent possible management policies that each country could follow in the absence of cooperation. The last two represent potential management options that could be undertaken by the two countries cooperatively.

In the absence of cooperative agreements, the fishery management alternatives are: fishing under open access conditions, a unilateral search for a maximum sustainable yield, and unilateral maximization of net benefits from fishing.

All three scenarios assume that each country has access to a fixed fraction of the entire transboundary shared fish stock. This assumption reflects the fact that a boundary between the two countries is enforced for political reasons.

Given the existence of cooperative agreements, the management alternatives are: joint maximization of net benefits recognizing the existence of a national boundary, and joint maximization of net benefits in a common fishing zone.

Main Conclusions

This study sets out to determine the net benefits that would be generated under alternative management strategies for the sardine and anchovy shared fish stocks and to evaluate the socioeconomic impact of these management alternatives. The authors conclude that:

The net benefits generated in the absence of a cooperative agreement are smaller than those generated when a cooperative agreement is in existence.

With cooperative agreement, the optimal level of joint exploitation of the fishery yields higher net benefits when the two countries agree upon a common fishing zone, than when they maintain separate national zones.

Regardless of whether there is, or is not, a cooperative agreement, a management strategy that seeks to maximize net social benefits yields higher benefits to society than does a management strategy designed to maximize the fishery's physical yield.

The first analysis shows the socioeconomic impact of different management strategies in the absence of cooperation. The main conclusion is that management intervention is better than no intervention.

It is also concluded that the total net benefits from the Chile-Peru fishing area, under a management policies seeking to maximize unilaterally physical yield, net social benefits will be greater than those arising from open access fisheries. It is also concluded that total fishing effort and fishing fleet size will be reduced in the country undertaking an active management policy.

A management policy seeking to maximize physical yield will yield significantly lower net benefits to society than will a policy seeking to maximize net social benefits.

The study emphasized the impact that one country, following a policy of open access, would have upon the other country, if the other country was following an active resource management policy. If the country following an active management policy unilaterally reduced harvest rates, there would be an increase in the shared fish stock. The country remaining under open access would take advantage of this increase in fish stock, increasing its fishing effort and harvest rates, and would end up better off compared with its original open-access bioeconomic equilibrium. The country following the active management policy would achieve smaller benefits than it had expected. In terms of harvest rates, the country following the active management policy would be worse off than if it had followed a policy of open-access.

These results show that, despite the secondary effects not considered by unilateral management policy interventions, and according to resource economics theory, the management policy seeking to maximize net

social benefits is clearly superior both to the policy seeking to maximize physical yield and to the policy of no intervention at all.

A comparative analysis shows that, the cooperative management, while maintaining national fishing zones, leads to greater benefits, than even the best management strategy in the absence of cooperation.

Although unilateral maximization in the absence of cooperation has a positive economic impact in terms of total net benefits for the CPFA, it leads the country remaining under open-access conditions exiting from the fishery. This would not occur under joint maximization under a cooperative agreement, and the maintenance of national fishing zones. Furthermore, the implementation of a unilateral maximization strategy, leads to the same result as a bargaining situation, in which one of the countries involved has all the negotiating power, thereby making it potentially unfeasible politically.

A comparison of the two management strategies that seek to maximize net benefits jointly under a cooperative agreement shows that establishing a common fishing zone (CFZ) yields superior results to establishing, and maintaining national fishing zones MAXJ. This is true even though establishing a CFZ would lead to a lower stock size, less fishing effort or a smaller fleet.

The fundamental question to be answered in this analysis is whether the difference between the points on the bargaining frontier for the two management alternatives, MAXJ and CFZ, and the threat points (open-access status quo) is sufficiently large to motivate the two countries to attempt to negotiate an agreement. Results from running both scenarios show that both management strategies would yield better results than the open-access status quo. Furthermore, joint maximization management policy may have a higher probability of being adopted under CFZ than under MAXJ.

The results also show the socioeconomic impact of the cross-effects of implementing the two management alternatives under a cooperative agreement. The differences between the countries' fleets, in terms of bioeconomic efficiency would lead to different results for the two countries, when moving from MAXJ to CFZ. Under these circumstances, each country would attempt to move toward the management alternative that appears most favorable to it.

Finally, authors summarize the results for the five management strategies modeled as follows:

- Seeking to maximize net social benefits is a better strategy than seeking to maximize physical yields.
- Joint maximization yields higher net benefits under cooperation, than it does in the absence of cooperation.
- A management policy that seeks to maximize net economic benefits over time and that maintains a common fishing zone is the optimal management policy for a transboundary shared stock.

CURRENT SITUATION OF SHARED STOCKS

Although the results of Agüero and Gonzales paper show cooperative management is the best strategy for the two countries, the authors will probably have to revise their estimates in light of changes, which have occurred in the fisheries during the last few years. Data presented at the last IMARPE-IFOP workshop indicate a decline in biomass levels. This is particularly true in the case of sardines

This conclusion arises from the analysis of small pelagic fisheries of anchovy and sardine found in the area South Peru and North Chile[1] presented at the last meeting of the Working Group.

Sardine fishery

A fishing index for this fishery, based on catch landings and fishing effort, shows a fishery that was developing between 1974 to 1985 years, and which then went through a period of steady decline until 1999. In 1999 slight upward growth was noted. The landings reached a minimum level of 22 000 t and 4 000 t in 1996 and 1997 respectively. The figure for 1997 represents an all time low.

[1] 6º Workshop Report of Working Group on small pelagic fisheries. IMARPE-IFOP.

Stock indices, total biomass by age, the spawning biomass and recruitment are parameters that characterize the stock situation. The results of the sequential population analysis (SAP) show that the abundance of the sardine increased from 1974 to 1980 and that after 1980, the stock experienced a steady decline.

Exploitation indexes show the variation of the intensity of the fishing and its effect on the stock (Fglobal). These indexes, based upon total fishing mortality and age of the fish (Fc), show the high level of resource exploitation. The fact that Fc increased, while the landings and biomass and effort increased is explained by the density dependence relationship between catchability and resource abundance.

Although there has been evidence of a slight improvement in recruitment in last years, recovery of the sardine stock in the medium term will require a favorable environment and a precautionary management policy.

Anchovy fishery

Annual pattern of catch and fishing effort indicates that fishing activity between 1984 and 1999 has been cyclical, with an increasing tendency occurring in period 1984-94, where maximums in 1986, 1989, 1994 and 1997 achieved, followed by declines in the last years due to unfavorable environmental conditions. The interannual pattern of anchovy catches in the two countries shows a high degree of correlation.

Of Anchovy recruitment increased steadily until 1995, with three maximums occurring in 1987, 1993 and 1995, with levels greater than 4.5 million tons. These strong year classes made the recovery of the stock possible, after the "El Niño" 1982/83. The strong recruitment increased the level of abundance of the stock. In period 1996-99, recruitment declined with levels being below average .However, it must be noted that estimates based upon Sequential Analysis of Population (ASP) are, in general, unreliable for the last year.

Variations in the average biomass of anchovy stock are correlated with the recruitment to the fishery. During the period 1984-1993, the average biomass of the stock showed an increasing trend, and reached a maximum level in 1993 of 14.9 million tonnes.

The spawning biomass showed an increasing trend from 1984 to 1996. It increased strongly in 1993 and 1996, due to the strong year classes of 1991, 1992 and 1995. The increase of the spawning biomass led to a stabilization of anchovy stock. During the period 1997-1999 the spawning stock declined sharply in 1999, the spawning biomass was only 1 million tonnes, which can be compared with the 1993 maximum of 14.9 million tonnes.

The main conclusion of the analysis undertaken was that in 1999 the fishing mortality rate was high, which indicates that the stock was still being heavily exploited. Nonetheless, the biological indicators, and the evolution of the ecosystem, show that the conditions for the recovery of the anchoveta biomass in the short term are favorable.

THE FUTURE OF COLLABORATION

The Humboldt Current Large Ecosystem Project

The Humboldt current ecosystem is recognized as one of the major upwelling systems of the world. The Humboldt current system is predominantly an equatorial flow of cold, low salinity water, with complex flows and counter-flows, out to 1,000 km from the Peru-Chile coast. The Humboldt Current LME is considered to be a highly productive ecosystem. The upwelling, which occurs in this region is almost exclusively responsible for the ecosystem's productivity.

Peru and Chile, the countries bordering this LME, are aware of the necessity of establishing close regional co-operation. In response to this need, a regional workshop for the joint stock assessment of sardine and anchovy for Southern Peru and Northern Chile was organized by IFOP and IMARPE in November 1999. IFOP is Chile's Fisheries Research and Development Institute, while IMARPE is Peru's Marine Research Institute.

Recently the project: "Integrated Management of the Great Marine Ecosystem of the Current of Humboldt", was approved. The project will be executed by IMARPE, and IFOP of Chile, and it will be financed by GEF. The United Nations for Industrial Development (ONUDI) will participate in the project, furthermore, the project will have the scientific support of National Oceanic Atmospheric Administration (NOAA).

The general aim of this project is to foster national and regional efforts leading towards the integrated management and sustainable use of Humboldt Current Large Marine Ecosystem.

The specific objectives of the project are:

Establishment of a mechanism for Regional Cooperation.
Improvement of the state of the knowledge on the Humboldt Current Large Marine Ecosystem.
Development of a Transboundary Diagnostic Analysis - TDA.
Development of a Strategic Action Program - SAP to deal with the deficiencies of management, and to provide protection against the threats, both of which are essential for a sustainable management of the Ecosystem, and
Development of the institutional capacities required for the integrated management of the Ecosystems.

CONCLUSIONS

This brief review of various aspects of joint investigations of key transboundary fishery resources in Southeastern Pacific Region, leads to a very clear conclusion, namely that there is a strong political will among the Regional countries to collaborate in establishing a management framework, which will allow them to exploitate of shared resources on a sustainable basis. Emphasis is given to the necessity improving knowledge of the factors, which impact those resources and its fisheries, and of the particular marine environment in which these resources inhabit. Also to be included in the joint research, are the economic and political implications of sharing those resources. It remains necessary to develop suitable institutional capacity in the region to confront the challenges. One example is provided by the need to do extensive work in harmonizing future policies and fishing legislation. The development of an effective management system that will enable the countries to move from the monospecific level to ecosystem level, must be done with the participation and consensus of all stakeholders, and must be done within the framework of Convention on the Law of the Sea It is necessary that the future fisheries management system be based on a more solid scientific base, and on the mutual interest of stakeholders of countries involved. In order to achieve this objective, and in order for the objective to be sustainable, it is necessary that all of the participants see the cooperative regime to be fair and equitable. This is a critically important task facing the Region of the Southeastern Pacific.

ANNEX I

TRANSBOUNDARY FISH STOCKS IN THE SOUTH EASTERN PACIFIC[1]

	A. FISH		
1.	Argentinidae Family		
2.	Bathylagidae Famil		
3.	Bramide Family		
	Brama japonica		
4.	Gonostomatidae Family		
5.	Alepocephalidae Family		
6.	Myctophidae		
7.	Exocoetidae		
	Cypselurus heterurus (R)	Pez Volador	Flying Fish
	Exocoetus volitans	Pez Volador	Flying Fish
	Hirundichtys spp	Pez Volador	Flying Fish
8.	Scomberessocidae Family		
	Scomberesox saurus scombroides	Agüjilla	
9.	Scombridae Family		
	Scomber japonicus	Caballa	Horse Mackerel
10.	Carangidae Family	Jurel	Green Jack
	Caranx spp.	Cocinero	
	Decapterus sp.	Jurel Fino, Jurelillo	Shortfin scad
	Elagatis bipinnulata	Cola Amarilla	
	Seriola peruana	Fortuno	
	Seriola rivoliana	Fortuno	
	Trachurus murphy	Jurel	Southern Jack Ma
11.	Coryphaenidae Family		
	Coryphaenidae	Dorado o Perico	Mahi Mahi
12.	Gempylidae Family		
	Gempylus serpens	Caballa culebra	Snake Mackerel
	Lepidocybum flavobrunneum	Escolar	Escolar
	Ruvetus pretiosus	Pez accitoso	Escolars, Oilfishes
	Thyrsites atun	Sierra Sur	
13.	Trichiuridae Family		
	Lepidopus caudatus	Basurero negro	
	Lepidopus xantusi	Basurero	
14.	Nomeidae Family	Nomeidos	
	B. SHARKS		
1.	Cetorhinidae Family		
	Cetorhinus maximus	Tiburón Canasta	
2.	Carcharhinidae Family		
	Carcharhinus falciformis	Cazón o Tiburón	
	Carcharhinus galapagensis	Cazón	
	Carcharhinus limbatus	Cazón	
	Carcharhinus longimanus	Cazón	
	Galeocerdo cuvieri	Tiburón Tigre	Tiger Shark
	Proinace glauca	Tintorera	
	C. QUELONIOS		
	Chelonia mydas	Tortuga carey	

[1] Doc. 006/04-98-SGC/CPPS.P.Alta Mar.- Segunda Reunión del grupo de Trabajo de Evaluación y Ordenación Pesquera en el Pacifico Sudeste y de Especies Transzonales y Altamente Migratorias. (Callao-Perú, abril 1998)

D. CEFALÓPODOS
Argonautidae Family
Argonauta cornuta
Ommmasterphidae — "Pota o calamar gigante"
Dosidicus gigas
Symplectoteuthis oualaniesis — "Jibia o Pota Cárdena"
Nototodarus sp.
Todarodes filippovae — "Calamar Pota"
"Jibia antártica"

Symplectoteuthis luminosa — "Pota luminosa"
Ommastrephes Bartrami — "Pota saltadora"

E. CRUSTACEOS

1. Aristedae Family
Benthesicymus tanneri
Gennadas scutatus

2. Sergestidae Family
Sergestes phorcus

3. Pasiphaeidae Family
Pasiphaea Magna
Pasiphaea americana

4. Oplophoridae Family
Systellapsis cristata
Acanthephyra curtirostris

5. Pandalidae Family
Plesionika martia

6. Ariesteidae Family
Benthesicymus tannen
Gennadas scutatus

F. MEDUSAS O MALAGUAS
Hidromedusas or Malaguas
Hidromedudas
Esciforrmedusas

DISCUSSION GUIDES

WORKING GROUP A:
RESOLVING ALLOCATION ISSUES
DISCUSSION GUIDE

Background

In reviewing the history of the management of shared fish stocks, it becomes clear that there are very few such resources that do not require effective cooperative management among the states/ entities exploiting them, if the resources are to be harvested on a sustainable basis. Achieving effective cooperative management regimes is, however, difficult. Cooperative management regimes, once established, can readily disintegrate, if based upon weak foundations.

If a stable and robust cooperative fisheries management is to be established, the first issue, which must be addressed successfully, is that of allocation. It is obvious that, for the cooperative management regime to be stable, the criteria established for allocation, and the application of those criteria, must be seen by all participants in the cooperative regime to be fair and equitable. At a minimum, each and every participant must be assured of being at least as well off under the cooperative regime as it would be in the absence of cooperation.

History also tells us that that the allocation system must be flexible over time, in order to accommodate unexpected shocks to the cooperative regime. If this flexibility is absent, then, what may have appeared to have been a fair and equitable system of allocation at the beginning of the cooperative management regime, may, over time, come to be viewed, by one or more participants, as grossly inequitable.

Before considering what is required to ensure ongoing fairness and equity, it is necessary to decide what in fact is to be allocated. The answer would seem to be obvious, namely shares of the TAC, or the equivalent thereof, to the fleets of the participating states/entities. Yet, it can be argued that what in fact is being allocated, or what should be allocated, is shares, over time, of the net economic (social) returns from the fishery (however one may attempt to measure these returns).,. To quote the 1992 FAO document, *Managing Fisheries and the Law of the Sea: A Decade of Change* (*FAO Fisheries Circular* No. 853), "---the model is that of an international regime that achieves stability by sharing the benefits deriving from the use of the resource----". The author of the FAO document cites the case of the Convention for the Preservation and Protection of Fur Seals in the Northeast Pacific. Four countries participated in what proved, over its 73 year history, to be a cooperative management regime that was very successful, in both economic and conservationist terms. In order to maximize the net economic returns from the resource, it was agreed that harvest allocations to the fleets of two of the four countries should be set equal to zero. These two countries were then compensated by their partners in the Convention, to ensure that both shared equitably in the economic returns from the fishery.

If the view is accepted that what is to be allocated is shares of the net economic (social) returns from the fishery, then the allocation of harvest shares to the participants' fleets is to be seen as but one of many ways of achieving that goal. If it is decided that this should be the only way that the goal is to be achieved, then bargaining constraints, perhaps severe constraints, will be imposed upon the participants over time.

Determining fair and equitable allocation criteria that are seen to be applied in a fair and consistent manner should be relatively straightforward in the management of transboundary stocks. Attached is a set of proposed allocation criteria prepared by ICCAT. Although concerned, by definition, with highly migratory stocks, which are not under discussion at this Expert Consultation, the ICCAT criteria should, nonetheless, prove to be relevant to the discussion (although item 27 in the ICCAT document is contrary to the previous discussion on the sharing of the net economic benefits from the fishery).

The formulation of allocation criteria and principles is likely to be a considerably more difficult undertaking in the case of straddling stocks. One is now concerned with establishing cooperative management arrangements, involving both coastal states and distant water fishing nations (DWFNs). It is one thing, if both coastal states and DWFNs are developed. It is quite another, if the DWFNs are developed, while the coastal states are developing, as is found to be the case in several parts of the world. Then it becomes necessary to consider the special needs of the developing coastal states.

The ICCAT criteria are particularly useful in this regard. They recognize the interests of artisanal, subsistence and small-scale coastal fisheries, the needs of coastal fishing communities and of coastal states' regions whose economies are overwhelmingly dependent on fisheries, and the contribution of the fisheries to the national food security/needs, domestic consumption, export income and employment. The ICCAT negotiations of these criteria were influenced by, on one hand, the interest of long-distance fishing nations to maintain their fishing possibilities with reference to historical and present exploitation of the stocks in question, and, on the other hand, by the interest of developing countries to allow the future development of their fisheries. The latter group of countries argued their case with reference to Article 24 of the UN Fish Stocks Agreement that calls on states to

"... give full recognition to the special requirements of developing States in relation to conservation and management of straddling fish stocks and highly migratory fish stocks and development of fisheries for such stocks. .... , in particular: (a) the vulnerability of developing States which are dependent on the exploitation of living marine resources, including for meeting the nutritional requirements of their populations or parts thereof; (b)
the need to avoid adverse impacts on, and ensure access to fisheries by, subsistence, small-scale and artisanal fishers and women fishworkers, as well as indigenous people in developing States, particularly small island developing States; and (c) the need to ensure that such measures do not result in transferring, directly or indirectly, a disproportionate burden of conservation action onto developing States."

Perhaps the most difficult allocation issue to be confronted in the management of straddling stocks is that of allocations to prospective New Members, and to those countries, which at the time of the establishment of a RFMO, express a "real" interest in the fishery, while not being engaged in the fishery. The problem is to develop allocation criteria for these two groups, which, at one and the same time, do not contravene the UN Fish Stocks Agreement (see Articles 8 and 11, in particular), and do not undermine the efforts of those engaged in establishing the RFMO. The ICCAT criteria provide some suggestions, but the suggestions are, in this instance, limited in scope and value. This important problem remains largely unresolved. One of the most useful contributions, which the working group could make, is to point towards solutions to this problem.

Expected Outcomes

The Concept Paper for the Expert Consultation lists, as one of the key issues for the Consultation to discuss, "the use of decision-making procedures criteria for the allocation of shared resources based upon transparent and equitable criteria". It is expected that the deliberations of the Working Group will bring forth a discussion of the appropriate decision making procedures for bringing forth a set of equitable and transparent criteria for the allocation of the economic and social benefits arising from fisheries based upon:

(a) transboundary fish stocks

(b) straddling fish stocks

It is also expected that the Working Group will identify key allocation criteria pertaining to each of the two classes of fish stocks.

The Working Group should elaborate specifically on the following points:

- Means of ensuring that the procedures and mechanisms for making allocations are flexible through time
- Determining allocation criteria for New Members to RFMOs that are seen to be equitable, but which also ensure the long term stability of the RFMO
- Allocation criteria that will meet the special needs and requirements of developing coastal states.

At its discretion, and with time permitting, the Working Group may discuss, and report upon, additional points, which it deems to be important.

ANNEX[1]

ICCAT CRITERIA FOR THE ALLOCATION OF FISHING POSSIBILITIES

I. Qualifying Criteria

Participants will qualify to receive possible quota allocations within the framework of ICCAT in accordance with the following criteria:

1 Be a Contracting or Cooperating Non-Contracting Party, Entity or Fishing Entity.

2 Have the ability to apply the conservation and management measures of ICCAT, to collect and to provide accurate data for the relevant resources and, taking into account their respective capacities, to conduct scientific research on those resources.

II. Stocks to Which the Criteria would be Applied

3 These criteria should apply to all stocks when allocated by ICCAT.

III. Allocation Criteria

A Criteria Relating to Past/Present Fishing Activity of Qualifying Participants

4 Historical catches of qualifying participants.

5 The interests, fishing patterns and fishing practices of qualifying participants.

B Criteria Relating the Status of the Stock(s) to be Allocated and the Fisheries

6 Status of the stock(s) to be allocated in relation to maximum sustainable yield, or in the absence of maximum sustainable yield an agreed biological reference point, and the existing level of fishing effort in the fishery taking into account the contributions to conservation made by qualifying participants necessary to conserve, manage, restore or rebuild fish stocks in accordance with the objective of the Convention.

7 The distribution and biological characteristics of the stock(s), including the occurrence of the stock(s) in areas under national jurisdiction and on the high seas.

C Criteria Relating to the Status of the Qualifying Participants

8 The interests of artisanal, subsistence and small-scale coastal fishers.

9 The needs of the coastal fishing communities which are dependent mainly on fishing for the stocks.

10 The needs of the coastal States of the region whose economies are overwhelmingly dependent on the exploitation of living marine resources, including those regulated by ICCAT.

11 The socio-economic contribution+ of the fisheries for stocks regulated by ICCAT to the developing States, especially small island developing States and developing territories[2] from the region.

12 The respective dependence on the stock(s) of the coastal States, and of the other States that fish species regulated by ICCAT.

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1) Source: Annex 8 of ICCAT 2001 Annual Report.

1 For the purposes of this document, the term "territories" refers only to the territories of those States that are Contracting Parties to the Convention in respect of those territories alone.

13 The economic and/or social importance of the fishery for qualifying participants whose fishing vessels have habitually participated in the fishery in the Convention Area.

14 The contribution of the fisheries for the stocks regulated by ICCAT to the national food security/needs, domestic consumption, income resulting from exports, and employment of qualifying participants.

15 The right of qualified participants to engage in fishing on the high seas for the stocks to be allocated.

D Criteria Relating to Compliance/Data Submission/Scientific Research by Qualifying Participants

16 The record of compliance or cooperation by qualifying participants with ICCAT's conservation and management measures, including for large-scale tuna fishing vessels, except for those cases where the compliance sanctions established by relevant ICCAT recommendations have already been applied.

17 The exercise of responsibilities concerning the vessels under the jurisdiction of qualifying participants.

18 The contribution of qualifying participants to conservation and management of the stocks, to the collection and provision of accurate data required by ICCAT and, taking into account their respective capacities, to the conduct of scientific research on the stocks.

IV. Conditions for Applying Allocation Criteria

19 The allocation criteria should be applied in a fair and equitable manner with the goal of ensuring opportunities for all qualifying participants.

20 The allocation criteria should be applied by the relevant Panels on a stock-by-stock basis.

21 The allocation criteria should be applied to all stocks in a gradual manner, over a period of time to be determined by the relevant Panels, in order to address the economic needs of all parties concerned, including the need to minimize economic dislocation.

22 The application of the allocation criteria should take into account the contributions to conservation made by qualifying participants necessary to conserve, manage, restore or rebuild fish stocks in accordance with the objective of the Convention.

23 The allocation criteria should be applied consistent with international instruments and in a manner that encourages efforts to prevent and eliminate over-fishing and excess fishing capacity and ensures that levels of fishing effort are commensurate with the ICCAT objective of achieving and maintaining MSY.

24 The allocation criteria should be applied so as not to legitimize illegal, unregulated and unreported catches and shall promote the prevention, deterrence and elimination of illegal, unregulated and unreported fishing, particularly fishing by flag of convenience vessels.

25 The allocation criteria should be applied in a manner that encourages cooperating Non-Contracting parties, Entities and Fishing Entities to become Contracting Parties, where they are eligible to do so.

26 The allocation criteria should be applied to encourage cooperation between the developing States of the region and other fishing States for the sustainable use of the stocks managed by ICCAT and in accordance with the relevant international instruments.

27 No qualifying participant shall trade or sell its quota allocation or a part thereof.

WORKING GROUP B:
ACHIEVING COORDINATION OF MANAGEMENT PLANS AND OBJECTIVES, AND OF RESEARCH PROGRAMMES

This discussion guide seeks to highlight some of the issues that need to be considered in order to achieve coordination of management plans and objectives and research programmes. It merely attempts to stimulate the discussion through some ideas but does not purport to be exhaustive in terms of either its scope or depth.

It appears useful to look at those issues first that have proven to be particular impediments in achieving coordination in the management of shared stocks. A tentative list of such impediments based upon the reading of the case studies is as follows:

- Asymmetries in the expectations of the various parties and stakeholders (the analysis would have to take into account various time scales: if some parties cannot survive in the immediate future, or know that in the medium term they will not participate any more in a fishery, long term merits of efficient management may be of little importance to them);
- In-adequacy of the scientific framework and bases (including the non-availability of the appropriate data, the absence of a recognized – neutral enough – scientific structure, as well as unrealistic - at least in a specific context - of some scientific models);
- Major changes in the geographic distribution and/or migration patterns;
- Fisheries on stocks of species with very long life spans (accumulated biomass problems, risks of irreversible damages, etc.);
- Difficulty to identify who must be considered as the negotiation partner for some fleets;
- Inadequate legal frameworks;
- Lack of equipment, human means and expertise.

The Group may elaborate on this list and analyze the consequences of these impediments on the management of shared stocks and discuss the pros and cons of the various ways and means that have been tried in different situations to overcome them.

Measures to reduce asymmetries in the expectations of the various parties may include consultation with the fishing industry and fishworkers to establish agreed objectives at the national level and then communicate those objectives in a transparent manner to the other parties. These would then form the basis from where to start the negotiation/bargaining process. Another or complementary approach could be to ensure that the stakeholders are adequately represented in the negotiations between the parties.

Cooperation in the management of shared stocks starts often with the exchange of scientific data on the biological characteristics of the stocks in question and perhaps joint stock assessment exercises. This is what some commentators have denoted as the first or primary level of cooperation. While good information on the fish stocks is indispensable for effective management, the fact that the initial cooperation is often confined to fisheries scientists may lead to, on one hand, narrowly focusing on issues relating to the fishery resources rather than the entire fishery (e.g. fishing capacity, economic performance, employment, etc.) and on the other hand, to establish management objectives in biological terms only. As a consequence, unrealistic targets may be set for the fishery in terms of the economic and social consequences that are implied by these targets for the parties concerned. The early transition to a higher level of cooperation, even in the absence of good data on stock abundance and current harvest levels, appears to be highly desirable in most instances.

A consequence of an otherwise desirable, early transition to a secondary stage of cooperation could be that scientific research may lose its benign character early on in the cooperative venture and become a "tool of combat".

The importance of independent scientific advice has been highlighted in many of the case studies. The setting up of a permanent body for this task (e.g. ICES) may in many instances, especially in developing countries, be a question of cost and cost-sharing, and alternative arrangements such as procurement of ad-hoc external expertise, may be more cost-effective.

Irrespective of whether a permanent body or reliance on ad-hoc external expertise are the preferred ways, these do not necessarily remove all hurdles in achieving unbiased resource assessments as long as the analyses have to rely primarily or exclusively on nationally collected primary data of catches and other biological characteristics. Some measures may be able to reduce "second-order" problems of generating unbiased scientific advice. These could include, for example, the regular exchange of statisticians and scientists between the relevant research and fishery statistics institutions of the parties, the conduct of joint fishery research surveys, the reciprocal placement of observers on board of vessels, etc.

The disastrous consequences of too little and too late cooperation in the management of shared stocks is well known and documented. The decline of several of such fisheries came about in spite of the availability of an abundance of scientific information to inform management decisions. What happened here was that no bargain could be struck early enough to prevent the worst to occur placing all parties in a worse condition than almost any "unfavorable" co-operation agreement could have achieved. Are there institutional arrangements that would facilitate reaching agreement on preliminary stop-gap measures that gain time and allow negotiations to proceed (which often are protracted and involve difficult trade-offs for each party)? One possible arrangement could be to establish an independent arbitration body (ad-hoc or permanent at regional or sub-regional levels) whose judgment would be binding on the parties concerned until a negotiated settlement has been reached, or the immediate threat to a disastrous stock decline is averted.

As has been pointed out elsewhere, a significant constraint in reaching a cooperation agreement is where benefit sharing from a shared stock is confined to the allocation of harvesting entitlements to each party. In this connection, the importance of side payments has been stressed in widening the bargaining space and finding a mutually acceptable agreement. A side payment, in its simplest form, is a type of transfer, which may be either monetary or non-monetary in nature.

An important feature of allowing for side payments, in addition to facilitating co-operation when management objectives of the parties differ, is that it can help too to deal with risks and uncertainties. Side payments can be used to make ex-post adjustments to unpredicted changes in say the distribution of a fish stock between the EEZs of the concerned parties, changes in catchability, or else other events that alter the stream of net benefits to the parties in an unexpected way.

At the institutional side, the pros and cons of the establishment of a management organization with its own staff (i.e. a bilateral, sub-regional or regional fisheries management organization) or just a system whereby the decision-makers of each party meet regularly (at least once a year), need to be careful weighted in each specific context. Considerations such as the scale and value of the shared fishery, the number of parties, the availability of trained staff, research facilities and equipment, financial resources, etc. would all have a bearing on whether or not a permanent structure is advantageous. Similar considerations would likely also guide the decision on which management tasks should be fulfilled by the bilateral or multilateral management organization and which tasks should remain with national institutions.

Whatever the allocation of functions between national institutions and the bi-or multilateral organization, there is obviously a need to ensure that management plans and research programmes are developed in an integrated fashion.

The issues raised above are by no means an exhaustive list and, at its discretion, the Working Group may discuss, and report upon, additional points, which it deems to be important.

WORKING GROUP C:
ENSURING IMPLEMENTATION AND ENFORCEMENT OF FISHERIES MANAGEMENT ARRANGEMENTS FOR SHARED STOCKS

This discussion guide seeks to highlight some of the issues surrounding the implementation and enforcement of fisheries management measures which the Group may, or may not, wish to consider in the course of its discussions. The guide does not purport to be exhaustive in terms of either its scope or depth. Rather, it serves to promote ideas for discussion that the Group may address.

Introduction

Parties to an arrangement agree on the type of measures to be adopted and implemented for the management of shared stocks. The measures are designed to achieve pre-determined management objectives which may vary from fishery to fishery depending on particular stock needs and circumstances. However, the underlying principle of fisheries management is that measures should seek to ensure that stocks are harvested in a long-term sustainable and responsible manner, taking account of broader ecosystem, social and economic considerations.

Fishers' authorizations (licences) and the number of authorizations issued to harvest shared stocks should:

- reflect the objectives and intent of management, and
- be consistent with the agreed management measures.

If this is not the case management objectives are unlikely to be realized.

Undermining efforts to management shared fish stocks

Activities by unauthorized fishers and fishers that do not abide by the terms and conditions of their authorizations undermine efforts to manage fish stocks. This is likely to lead to the overexploitation of stocks and impairment to efforts to rebuild when stocks are already overexploited.

Illegal, unreported and unregulated (IUU) fishing is an issue high on the international fisheries agenda. Some commentators maintain that it is the major issue confronting fisheries management. This is because the incidence of IUU fishing:

- is widespread in all fisheries and in all oceans;
- is not confined to a small group of vessels, and
- severely handicaps the work of regional fishery management organizations or arrangements (RFMOs) to manage stocks.

IUU fishing is perpetrated by both unauthorized and authorized fishers. Its root cause is a lack of effective flag State control. States operating open registries, and which issue so-called flags of convenience (FOCs), are frequently blamed for IUU fishing. However, such fishing is not confined only to open registry States or unauthorized fishers. The problem is wider. Some RFMOs have demonstrated that IUU fishing is perpetuated by authorized fishers from among their membership.

An International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU) has been concluded by the FAO membership. This IPOA seeks to address IUU fishing in a holistic, broad and somewhat novel manner by focussing on the:

- responsibilities of all States;
- flag State responsibilities;
- coastal State measures;
- port State measures, and
- internationally agreed market-related measures.

In addition, the IPOA-IUU gives RFMOs, which are usually in front-line positions with respect to the impact of IUU fishing, a particular role to play in combating IUU fishing.

States and RFMOs should address IUU fishing if their efforts to manage stocks are not to be undermined. Issues that the Group may wish to address could include:

- what steps can be taken to deter IUU fishing by unauthorized fishers? RFMOs and their members can instigate a number of activities. These activities may include contacting flag States with information relating to vessels that are undermining management efforts and request that the vessels desist; make information available publicly on websites etc about the names and flags of vessels involved in IUU fishing, etc. Such initiatives will require the cooperation and goodwill of the flag States whose vessels are fishing and undermining management arrangements.

- what steps can be taken to ensure that authorized fishers adhere to the terms and conditions of their licences to fish? How can sanctions against such fishers and their vessels act more effectively as deterrents against IUU fishing? Sanctions must be severe so that fishers incur a real and substantial economic loss when they have been found engaging in IUU fishing. Penalties such as the loss of the authorization to fish and the forfeiture of the vessel could be considered as options.

An important aspect of deterring IUU fishing is the need to have States implement fully all international binding and voluntary instruments that promote sound and responsible fisheries management. The instruments include the 1982 Convention, the 1993 FAO Compliance Agreement, the 1995 UN Fish Stocks Agreement and the IPOA-IUU.

Routine and ongoing monitoring, control and surveillance of fishing activities

A checking or verification process, through monitoring, control and surveillance (MCS), is required to ensure that fishers abide by their authorizations to fish. This process is an integral component of management. MCS seeks to facilitate compliance by fishers. MCS is not intended to penalize or constrain fishers who operate within the terms of their authorizations.

The checking process involves routine and ongoing MCS. It may include a range of activities such as:

- the use of VMS to monitor vessel positions, fishing activities and reported catches;
- the use of vessel registers;
- at sea checks of vessels, logs, and catches by patrol craft;
- at sea inspection of vessels by aircraft (alone or in concert with patrol craft);
- the use of independent and trained observers to assess catches, species composition etc and to generally report on whether fishers are operating according to their authorizations;
- port inspections of vessels, catch onboard vessels and catch offloaded, and
- cooperative or regional MCS arrangements, as used by some RFMOs, including joint and reciprocal enforcement arrangements.

The implementation of MCS programmes is a major challenge. In shared stocks fisheries effective and sustained international cooperation is essential.

The size and sophistication of a MCS programme for the management of shared stocks will depend on a number of issues including the:

- administrative structure in place for management;
- resources (funds and hardware) available to support the programme;
- number of parties involved in the fishery;
- number of fishers;
- number of species and volumes of fish being taken;
- geographic distribution of the stocks being managed;
- geographic distribution of landing points and markets, and

- cost of the programme and who pays for it (possibly through cost-sharing arrangements with industry).

Fisheries administrations should underscore its positive role of MCS in management; it is not intended that MCS should denigrate into a "them" and "us" situation where fishers are placed in an adversarial role with managers.

Responsible fishers generally understand and accept the need for effective fisheries management and part of this understanding entails on appreciation of non-discriminatory and swift enforcement action when it is needed.

Penalties for infringements should have a high degree of equity among parties in a management arrangement and be of such a magnitude as to encourage compliance by fishers. Equity is an important consideration: fishers will be less inclined to comply with their authorizations if fishers from other parties do not face equivalent sanctions.

A further aspect is the need to share information about infringements and penalties imposed as a means of building confidence among parties to an arrangement. This will build confidence among fishers if they know they penalties among parties are roughly equivalent.

Positive thinking: partnerships with industry in fisheries management

Increasingly, fishers and other stakeholder are being called to play a more active role in fisheries management. It is now recognized that in order to promote a higher degree of responsibility and compliance by fishers, they should have a role in decision making.

An underlying tenet of the concept of responsible fisheries is the principle of responsible behaviour by fishers and other stakeholders. Efforts to engender the need to act responsibly and to comply with management measures should be promoted. Fishers should be urged to feel proud in having acted responsibly while fishing and not smart at having beaten the law when they have acted irresponsibly.

Underpinning the philosophy of broader fisher participation in management is the notion that fishers should contribute financially to the costs of management because they are the principal beneficiaries. Contributions should be made to meet some of the management-related research costs (when fishers participate in the determination of research priorities) and fisheries MCS. For situations where fisheries do contribute financially, a higher degree of interest and involvement by industry can be anticipated.

Promoting an inclusive approach to management requires some fundamental changes in the thinking of fishery administrators. Such management serves to discourage confrontation in the management process and has the real possibility of lowering the costs of management. However, it has not found wide acceptance in all countries and has recently been described by a fisheries manager as "... putting the rabbits in charge of the carrot patch ... ".

Some of initiatives that might be taken to facilitate greater participation by fishers in management could include:

- seeking input from industry on the priorities for research – with input from fishers it can be anticipated that research priorities will have a sharp applied focus;
- consultation with scientists, managers and MCS staff concerning research findings, the framing of management measures and options for the most effective approach to the implementation of MCS programmes;
- using fishers' organizations to disseminate information about research, management measures and in particular the rationale underlying such measures, and MCS, and
- seeking contributions from industry to support research and MCS programmes.

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